MODERN PLASTICS

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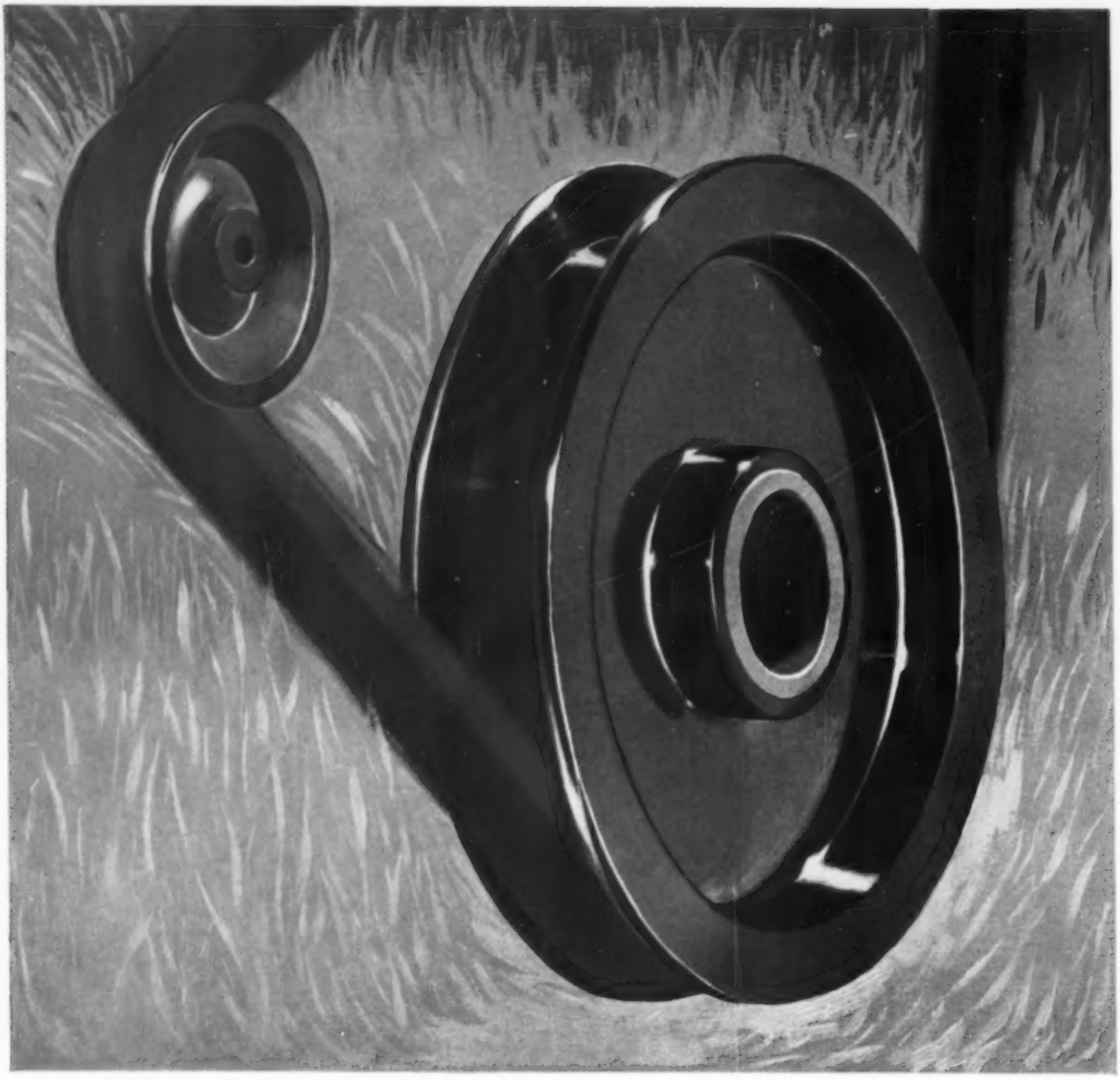
New directions in rigid urethane foams *p. 82*

Polypropylene: what the molder should look for *p. 87*

Formulating chemically blown vinyl plastisols *p. 135*

OCTOBER 1961

One of a series directed to IDEA-MEN



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MODERN PLASTICS

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• THE PLASTISCOPE

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• EDITORIAL

Let's stop this tradename nonsense . . 81

Proprietary plastics nomenclature has grown to unwieldy proportions. What's needed right now is a system of sensible and universal material designations to facilitate plastics specification in the growing fields of building, transportation, and appliances.

• GENERAL

New directions in urethane foams—Part I: The rigids 82

Although 1960 sales were only 10 million lb., rigid urethane foam is expected to reach an annual volume of 250 million lb. by 1970. Behind this anticipated growth lie important new developments in processing technology as well as advances in formulation. Here is an outline of the significant trends —in production methods, price structures, volume markets, and formulations.

Polypropylene: what should the molder look for? Part II 87

Of the half-billion lb. of PP expected to be sold by 1965, about 150 million lb. will be for injection molding. Despite some rumors to the contrary, the material cannot be processed "in any old mold" or like any other plastic. It requires different temperatures and pressures in both molding and extrusion, new concepts in gating, different coloring techniques, and special mold designs. The processor must also be conversant with the subjects of melt flow rates and shrinkage factors. Special table lists applications where PP is replacing other materials.

New process for facing concrete blocks 91

A three-layer molding procedure, involving the use of a gel coat to provide a highly polished surface, gives to cement blocks a degree of lustre approaching that of glazed tile at an installed cost of up to one-third less.

Switch from metals to plastics cuts costs up to 90% 92

Manufacturer of business machines effects such impressive savings on many of the 500 parts which are produced in its own molding plant. Six specific case histories are cited.

Filament winding goes commercial . . 94

Cover story: Now that filament-wound structures have proved their mettle in the nation's missile and space program, industry has started to adapt this technique to non-military uses. Article outlines the areas of application breakthroughs, gives the economics of this process, and takes a look into the future. One possibility—railroad tank cars.

PE tames neutrons 97

What are the strong points of PE usage in applications using nuclear power—and what are its limitations? The market potential is considerable: nuclear submarines carry tens of thousands of pounds of PE sheet for neutron shielding; a single merchant ship can require as much as ¼ million lb., and a single guided missile cruiser holds approximately ½ million pounds.

Epoxy passes toughest test: outer space 100

Construction details on the Courier 1-B communications relay satellite that has established the performance potential of reinforced epoxy under conditions of extreme heat and cold, intense radiation, and high vacuum. The vehicle is expected to be in orbit for several years. Its success holds important lessons to the industrial end-user.

New Developments 159

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• ENGINEERING SECTION

How to select a vacuum system for thermoforming 105

A major factor in thermoforming is the vacuum system. It influences speed of the forming cycle, sharpness of detail, and part shrinkage. For opti-

mum results, the former should know the required size of the vacuum reservoir and pumps, and should be able to determine the minimum cycle time for a given job. Here are several numerical examples that show how.
By P. F. Charles

A guide to molding high-density PE . . 110
Recommendations of optimum processing conditions to achieve certain properties in the molded part. The effects of molding variables on shrinkage, warping, dimensional stability, color, and physical properties are analyzed. Most of the work was done with a 0.96-density polyethylene resin with a melt index of 5.
By Roger B. Staub

You can control brittleness of high-density PE 125
Result of a study to understand the transition from ductile to brittle behavior of high-density polyethylene and to devise means of overcoming brittle fracture in molded PE items. Three factors were found to be most important in this respect: control of mold temperature, control of injection dwell pressure, and selection of the right resin.
By T. S. Brazier and Bryce Maxwell

• TECHNICAL SECTION

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Vinyl foam-fabric laminate represents several million pounds of chemically blown plastisol foam compound each year. Since these foamed products may be produced via the plastisol technique, a need has arisen to better understand the function of each of the formulating ingredients in these compounds. This article presents data on the effects of fusion and blowing temperatures, of type and amount of blowing agent, plasticizer, and stabilizer, and of viscosity on the density and quality of plastisol foam chemically blown at atmospheric pressure.
By Arnold C. Werner

Characteristics and applications of thermoplastic polyurethanes . . 146
Thermoplastic polyurethanes are now available which permit production of products with conventional thermoplastic processing equipment and solution techniques. Their applications include injection- and compression-molded items, calendered sheeting, coatings and finishes, and extruded jacketing, tubing, and profiles.
By C. A. Waugaman

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• Coming up . . .

The latest automotive plastics applications are the subject of our November lead article . . . Commercial implications of heavy-duty military packaging . . . Latest markets for rotationally molded polyethylene powder . . . Progress in flexible urethane foams . . . Engineering lead: mold design for polystyrene foam . . . Blow molding of polyacetal resin . . . Blow-up ratio for plastics tube production . . . Technical lead: high-molecular-weight polyethylene . . . Static pressures on polymer melts . . . Ultraviolet stabilizers . . . Also in the works: The thermosetting plastisols . . . Developments in methacrylate polymers and copolymers . . . Intumescent coatings for plastics . . . Polypropylene film and sheeting.

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Member Audit Bureau of Circulations, Associated Business Publications, The Society of the Plastics Industry, Inc., and other plastics associations throughout the world. Modern Plastics is regularly indexed in the Applied Science & Technology Index and Industex. Printed in U.S.A. by Hildreth Press, Inc., Bristol, Conn.

Modern Plastics issued monthly by Breskin Publications Inc. at Emmett St., Bristol, Conn. Modern Plastics Encyclopedia Issue published as the second issue in September by Plastics Catalogue Corp. at Emmett St., Bristol, Conn. Second class postage paid at Bristol, Conn. Subscription rates (including Modern Plastics Encyclopedia Issue): in U.S., its possessions, and Canada, 1 year $6, 2 years $14, 3 years $18; all other countries (payable in U.S. currency), 1 year $25, 2 years $45, 3 years $60. Single copies in the U.S., its possessions and Canada, $1 each (Encyclopedia Issue, $4); all other countries, $2.50 (Encyclopedia Issue $8). Contents copyrighted 1961 by Breskin Publications Inc. All rights reserved including the right to reproduce this book or portions thereof in any form. No connection with any company of similar name.
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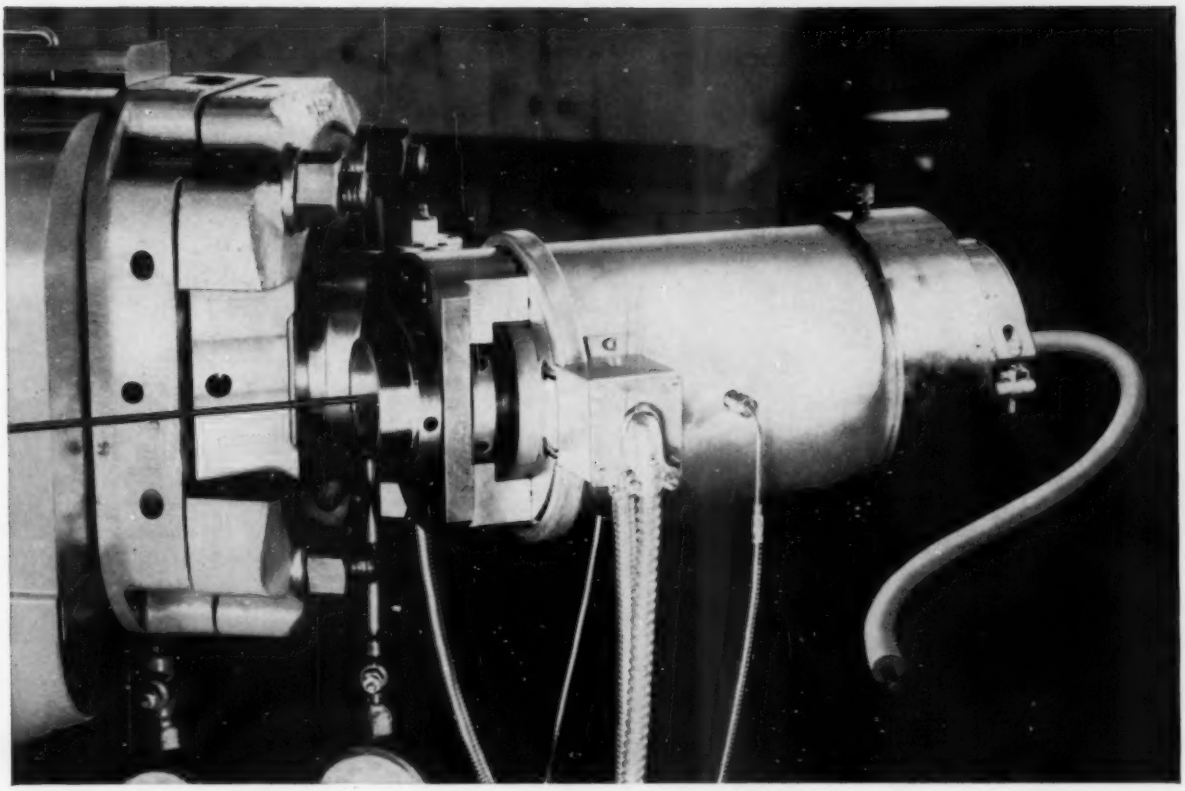

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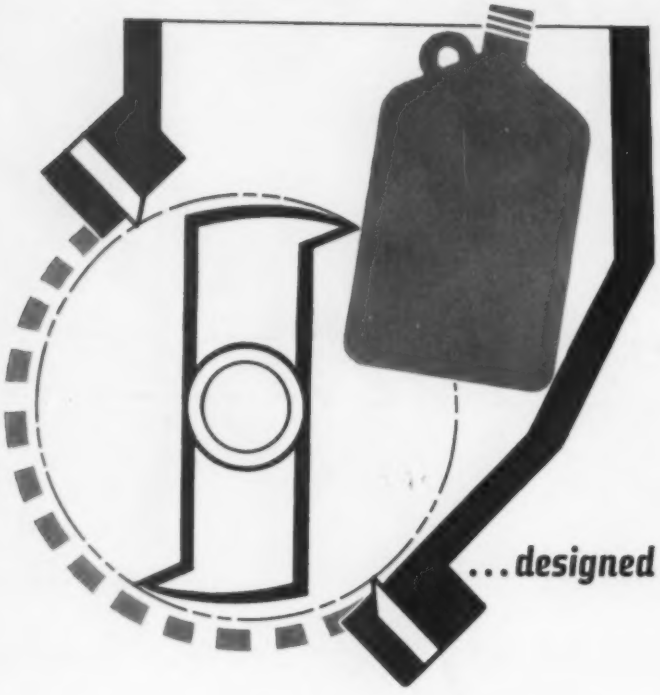

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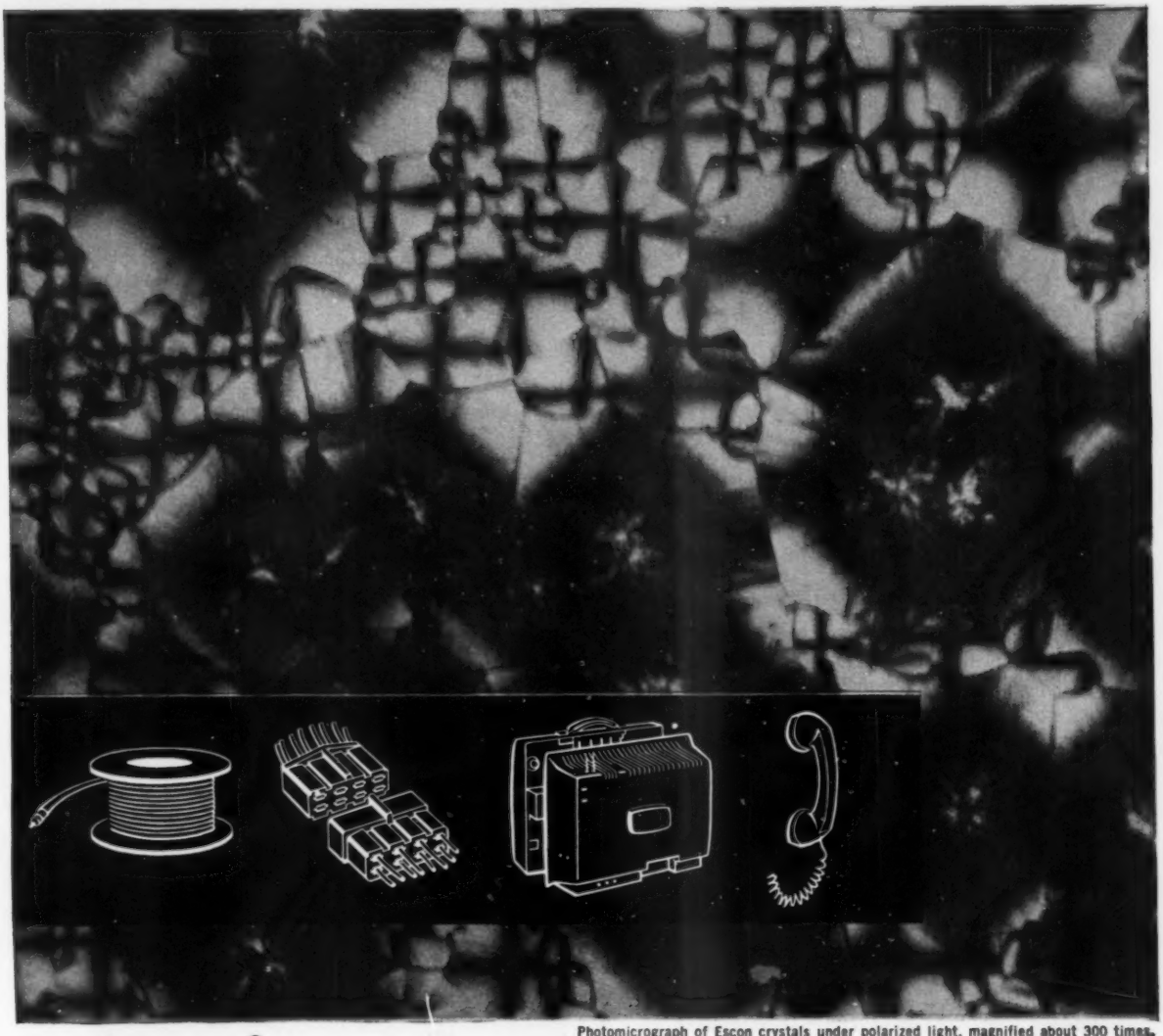

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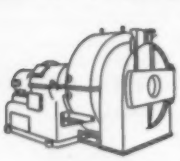

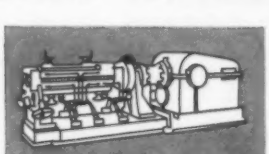

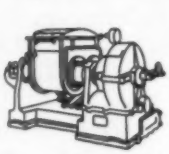

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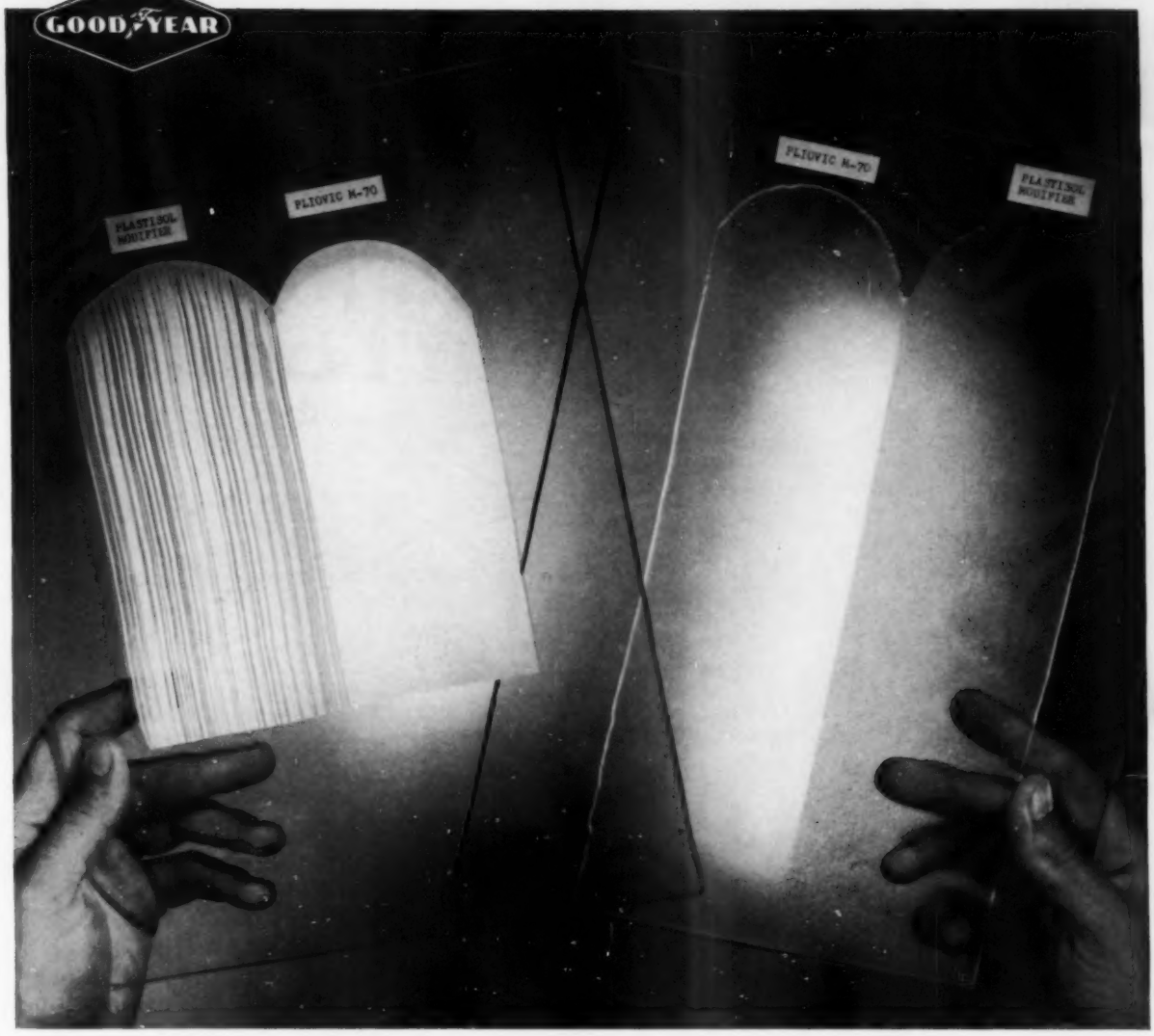

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Amos Installs Natco Screw-Rams

"They're Great"...says Gerald Hathaway, Molding Superintendent, Amos Molded Plastics, Edinburg, Indiana

"Quality is important at Amos. We specialize in the custom molding of large precision parts. Our new Natco Screw-Ram machines are producing parts of extremely high quality involving good finish, excellent color, and dimensional stability."

"We have both 425 and 850 ton Natco Screw-Ram machines in our plant with additional Natcos on order. For the first time, plasticizing capacity is no longer a limiting factor in injection molding. Our new Natco extruder machines produce better melt and more melt than we can use. Stock temperatures are considerably lower, resulting in better cycle time. In addition, we have found these reciprocating screw preplasticizers give us quick color changes and exceptionally low scrap rates."

Natco Screw-Ram injection molding machines are built in stock sizes from 35 to 140 ounces. Write for information.

THE MOLDER'S MOLDING MACHINE

NATCO
SCREW RAM

NATIONAL AUTOMATIC TOOL COMPANY, INC.
PLASTICS MACHINERY DIVISION
RICHMOND, INDIANA, U. S. A.

When you're running a Davis-Standard **thermatic** extruder

Temperature control makes the difference

Temperature control is the key to extrusion profits. It affects output speeds. Product quality. Maintenance costs. Operator efficiency. Even equipment versatility.

Davis-Standard patented Thermatic extruders control temperatures efficiently throughout the extrusion process.

Stable operating temperatures. Thermatic air cooling eliminates the sawtooth or "cycling effect" of heat-off-cool systems. With one setting it provides the correct temperature for **any** compound. Uniform heat dissipation avoids "thermal shock", prevents compound degradation or machine distortion.

Rapid cool-off. Thermatic extruders cool quickly, evenly. Clean-up or screw changeover takes less time, lets you run another compound in short order.

No material limitations. You run any thermoplastic resin with precise temperature control, no matter what operating temperatures are required.

DAVIS-STANDARD

Division of
FRANKLIN RESEARCH AND DEVELOPMENT CORPORATION
14 WATER STREET, MYSTIC, CONNECTICUT

D-S thermatic

Here's how Thermatic cooling works

Overbalanced cooling throws burden of maintaining precise temperature on sensitive proportioning control instruments where it belongs. Cooling air from blower passes between cylinders' finned surfaces and cover's inner wall. Converging shroud forces air through finned sections, resulting in even cooling over entire surface of each cylinder section.

1. Two heavy-walled aluminum finned half-cylinders in each heat zone provide large radiating area in minimum space, dissipate heat fast.
2. Zone divider plate assures adjustable, accurate temperature control in each heat zone.
3. Dampers give high temperature "oven effect" operation, speed warm-up.
4. High capacity blower produces more than adequate air flow for proper cooling of all compounds, even stubborn resins that tend to build frictional heat.
5. Patented inner liner directs air flow around fins for even cooling around entire circumference of barrel, resulting in even heat dissipation.
6. Tubular cast-in resistance heating elements provide extremely long life with complete safety regardless of voltage. Serpentine shaped for uniform heating.
7. Intake damper provides infinite gradients of air intake for either natural draft or forced draft cooling.
8. Xaloy-lined cylinder.

Temperature control is one more reason why no one can beat your extrusion cost when you're running a Davis-Standard patented Thermatic extruder. Write for complete information.

ENDLESS CHOICE WITH LOW COST DUSTLESS DRYCOL®

colors for all thermoplastics in exact, pre-measured units

Color it *exactly* from batch to batch with the color you *want* from Dustless Drycol! Bold. Subtle. Any color! Metallic, fluorescent, opaque . . . or any other special effect! You choose it! Dustless Drycol has it!

Comes pre-measured for easy and precise coloring with either 50 or 100 pound quantities of any thermoplastic. You end the chance of weighing error. You carry no large inventories.

Write today for our Dustless Drycol color swatch catalog. It would pay you to know more about the money you can save and the quality coloring you can get with Drycol.

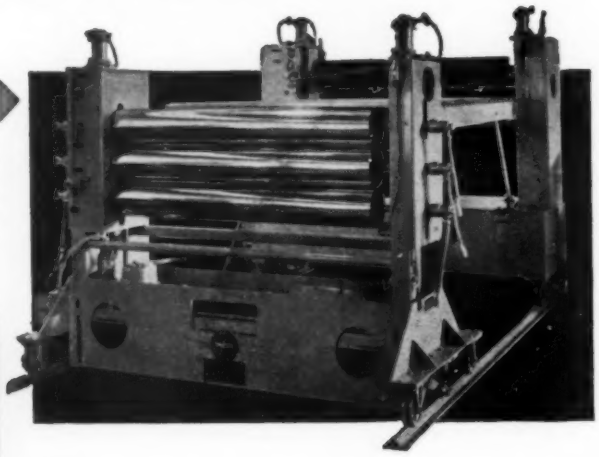
GERING
PLASTICS

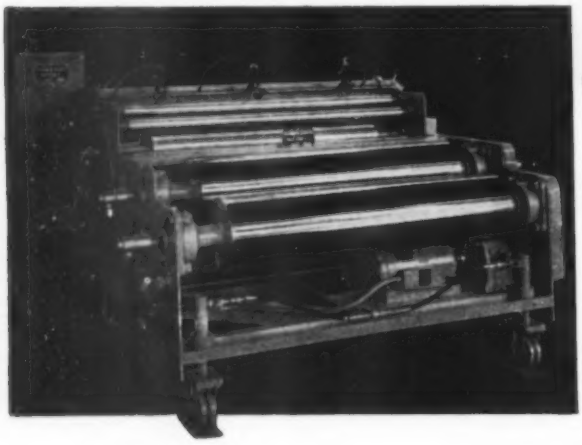
division of STUDEBAKER-PACKARD CORP.,
Kenilworth, N. J.

Cable Address: GERING, Kenilworth, N. J. Teletypewriter: TWX Cranford, N. J. 137 • Sales Offices: 5143 W. Diversey Ave., Chicago 39, Ill. • 1115 Larchwood Rd., Mansfield, Ohio • 103 Holden St., Holden, Mass. • 1855 Industrial St., Los Angeles, Calif. • 426 Los Niños Way, Los Altos, Calif. • P.O. Box 963, Minneapolis 40, Minn. • 2141 Sunnyside Pl., Sarasota, Fla.

These exciting new MPM ideas and features give you the finest in Thermoplastic Processing Equipment

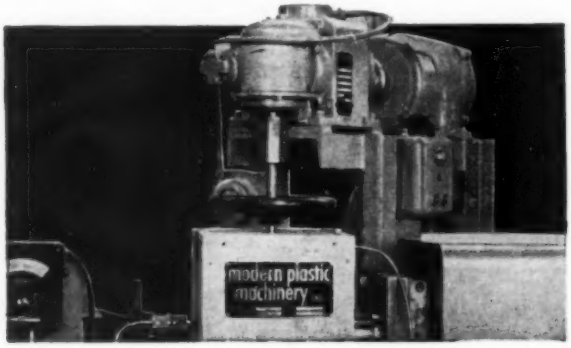
NOW EMBOSS RIGID STYRENE AND OTHER RESINS... for such products as lighting and decorative panels, new heavy sheet embossing equipment now makes casting dies for this purpose old fashioned. It's an exclusive new concept for the continuous production of any design on any standard width of rigid styrene. A complete line of MPM equipment is available for sheet embossing, from the extruder to the finished sheet.





FOR FILM AND SHEET PRODUCTION... from polypropylene, PVC and polyethylene, MPM's equipment is as up-to-date as tomorrow. MPM's patented "coat hanger" die provides uniform distribution of pressure and flow over the entire width of the film. Double shell roll construction with high velocity water flow assures a uniform temperature to produce high quality film. Roll surfaces are mirror polished to obtain the finest roll and film quality. The precise speed and tension control of our take-up units results in exceptionally uniform winding.

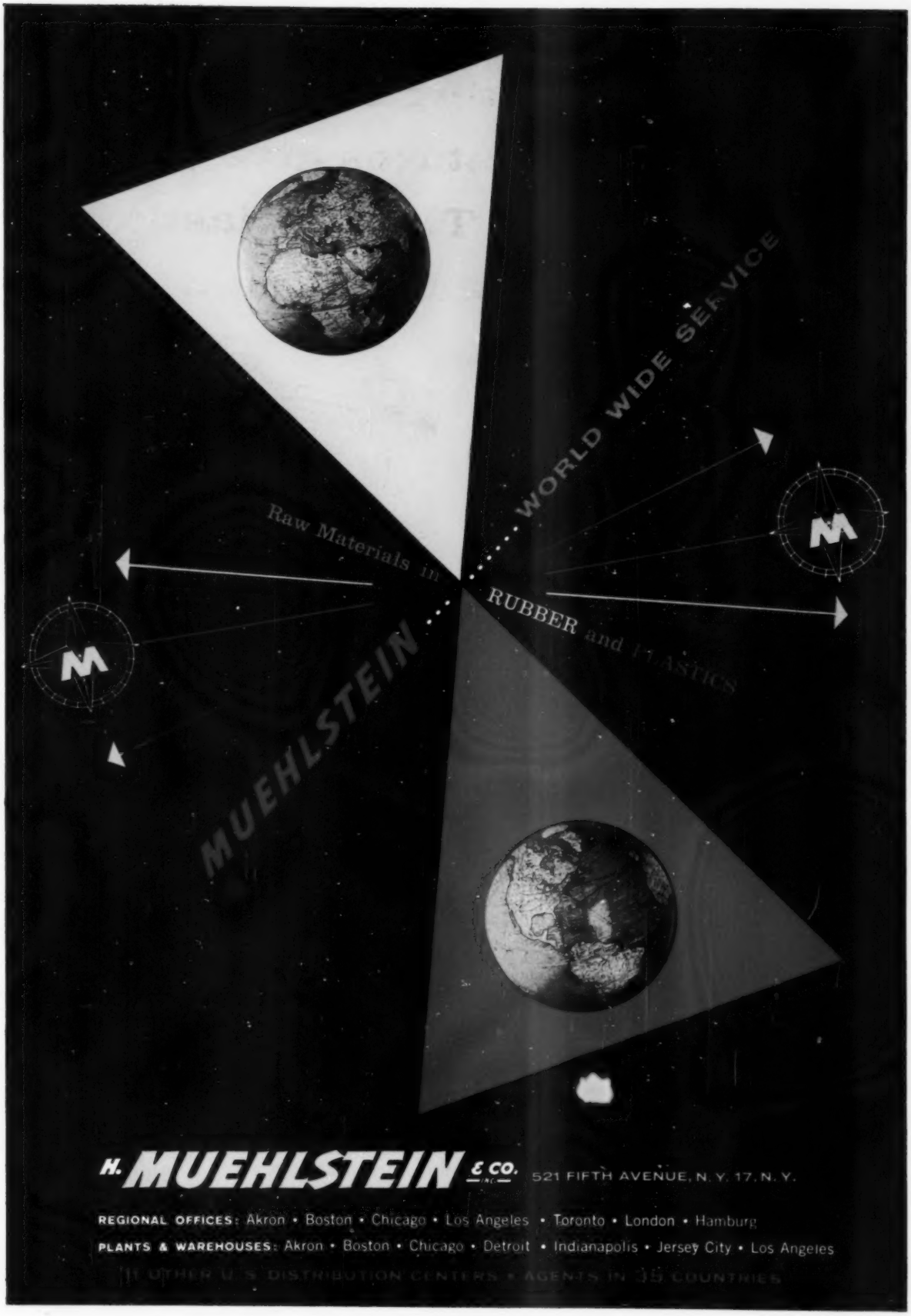
NEW DIE HEAD IMPROVES MONOFILAMENT PRODUCTION ... MPM's improved pump-type die insures uniform pressure, preventing breaking and uneven diameters. You're assured of constant, unvarying output and pressure regardless of pressure variations within the extruder itself. Complete monofilament lines, including extruder, dies, quench tank, godet units, drawing ovens and spoolers, are available from MPM.



For more information on these and other MPM machinery, write for our new 16-page illustrated catalog and specifications sheets.

Modern Plastic Machinery Corp.

General offices and engineering laboratories: 64 Lakeview Avenue, Clifton, N. J.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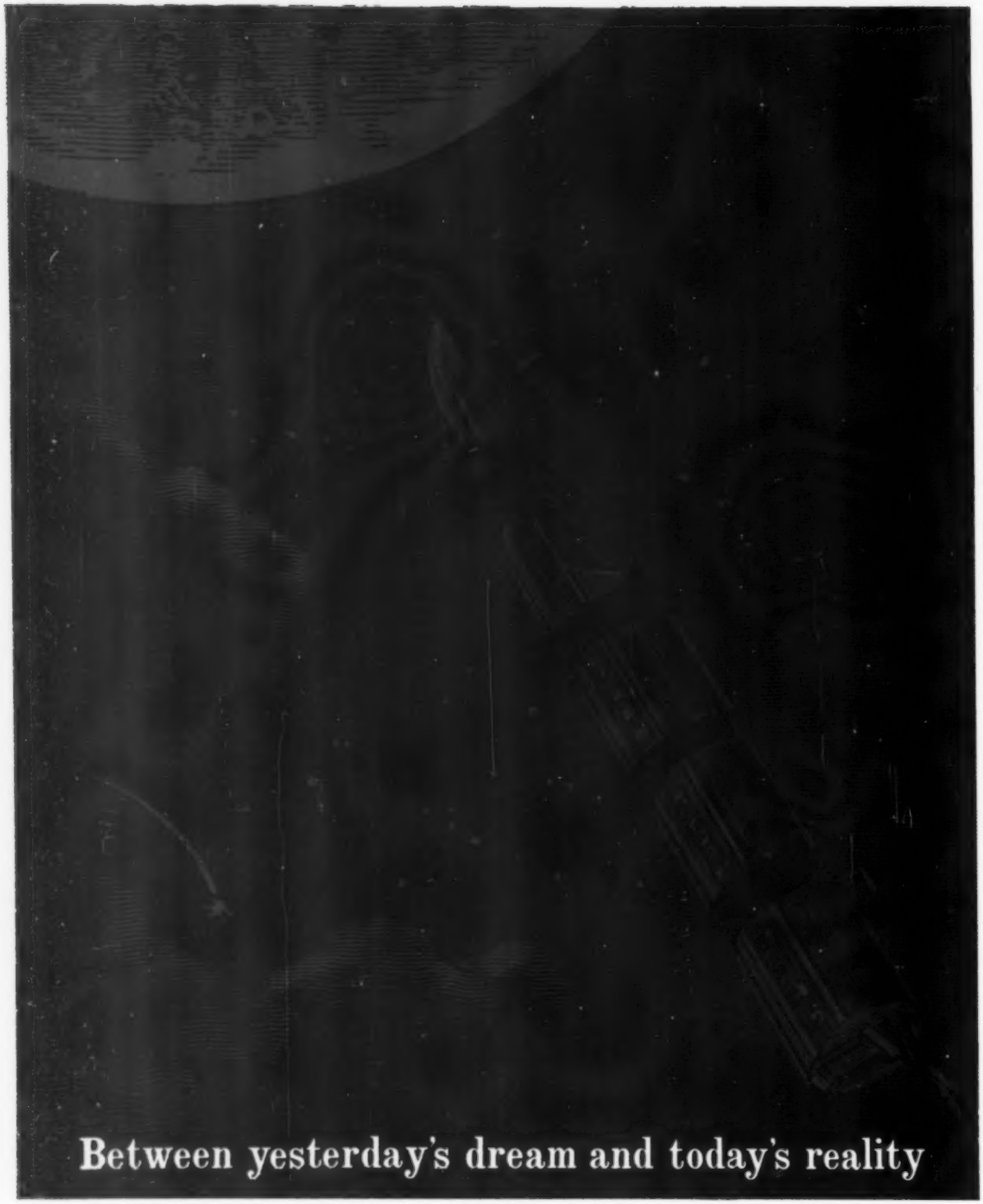


Burlington Glass Fabrics and Tapes

Hess, Goldsmith & Co., Inc. · World's oldest and largest weaver of glass
A Division of Burlington Industries · 1400 Broadway, New York 18

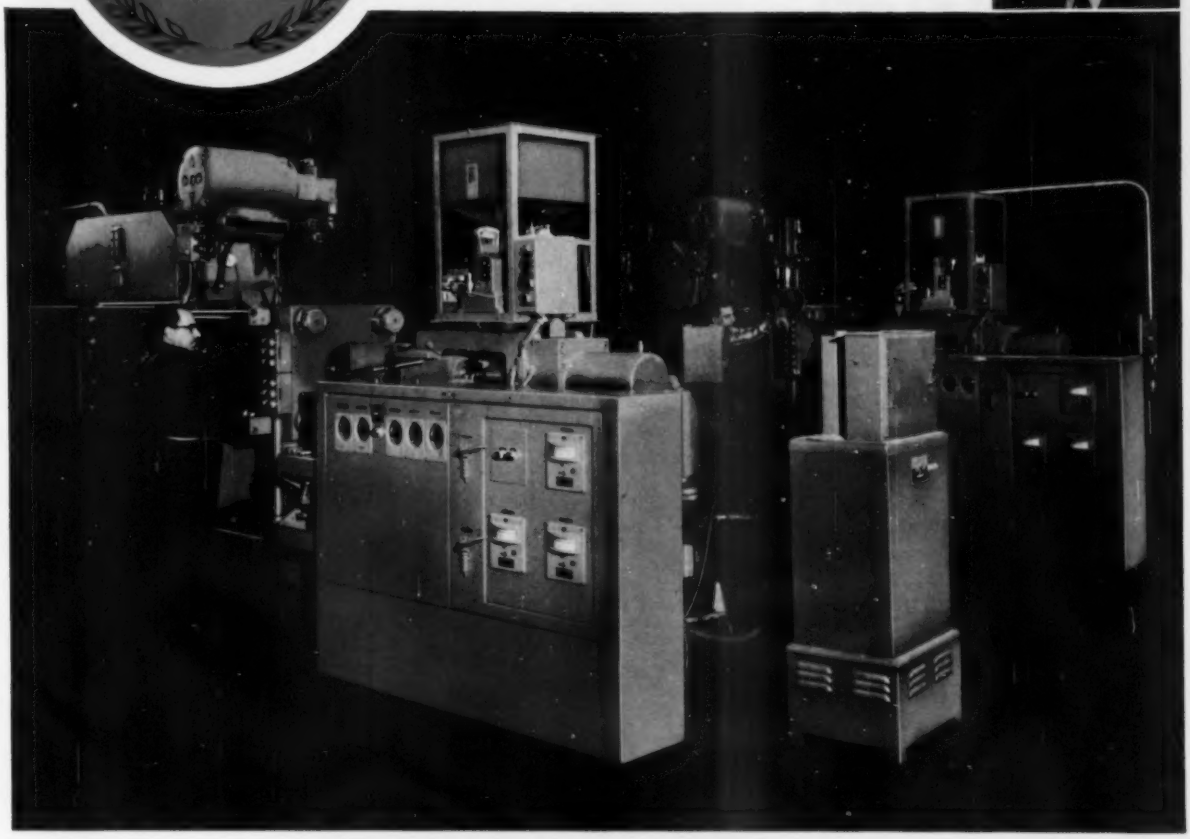
Research and Development: Cedar Grove, N.J., Greensboro, N.C., High Point, N.C. **Weaving:** Cheraw, S.C., Altavista, Va., Philadelphia, Pa., High Point, N.C. **Finishing:** Cheraw, S.C., Altavista, Va., Philadelphia, Pa., Cedar Grove, N.J.

Progress in Plastics by

A MOLDER ON THE MOVE

"We have 21 machines molding closures and packaging components. By modifying its standard injection machines to meet our high volume requirements, H-P-M builds us equipment that is steady and reliable. As a leader in this highly competitive field, we must have good machines to handle our round-the-clock production schedule. H-P-M's have always given us profitable service."

ARTHUR S. JACOBS, Vice-President & General Manager
Pittsburgh Plastics Division
The Heekin Can Company, New Castle, Pa.



Two of five new 6/8 oz. machines at Pittsburgh Plastics. Booster power units increase injection speed and operate mold screws. Special sequencing gives high speed automatic operation.

One line of H-P-M's at Pittsburgh Plastics Division, The Heekin Can Co.

H-P-M modified standards tops with packaging molder

The benefits of "custom design" to meet specific needs of a molder make H-P-M's interchangeable unit principle popular in the plastic industry. The right clamp tonnage, type of injection, injection speed, plasticizing capacity — without the penalty of special engineering costs — makes for greater profits. Choose from four types of injection — conventional plunger, two-stage plunger preplasticizers, single-stage extruder and two-stage extruder preplasticizers; clamps from 200 to 2500 tons; shot capacities from 6 oz. to 300 oz. Write for bulletin 6101.

H-107

H-P-M DIVISION Koehring Company Mt. Gilead, Ohio, U.S.A.

HPM

Speed... Precision... Versatility

DAKE

Reinforced Plastic Molding Presses

GUIDED PLATEN—Assures accurate alignment.

AUTOMATIC, SEMI-AUTOMATIC, OR MANUAL CONTROL—For production or experimental work.

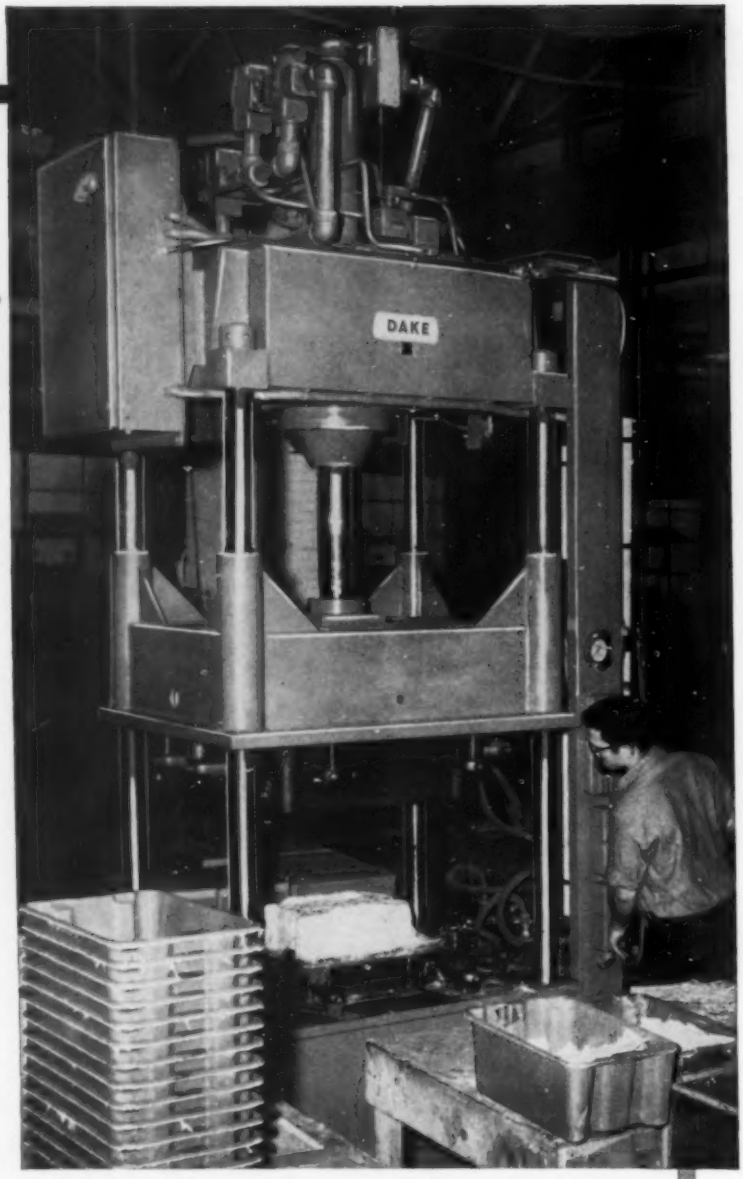
FAST RAM APPROACH—Allows for fast closing and return of movable platen. Slows automatically as work is approached.

ACCURATE, CONTROLLED PRESSURES—Give maximum on-the-job flexibility.

ELECTRIC TIMER—Holds pressure during curing cycle—adjustable from 3 seconds to 20 minutes. Ram returns automatically.

ADJUSTABLE STROKE CONTROL—Provides for automatic ram slowdown before contacting work.

ADJUSTABLE PRESSURE—From 1/3 press capacity to full press capacity.



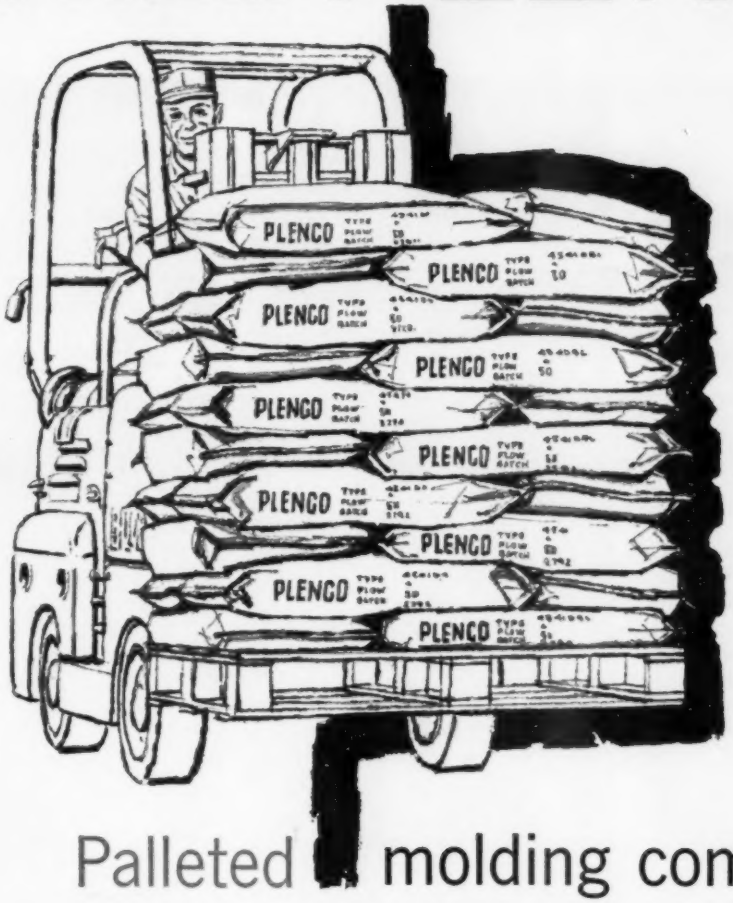
75-Ton Dake Guided Platen Plastic Molding Press forming Stack-n-Nest tote pans at G. B. Lewis Company, Watertown, Wisconsin.

Dake Guided Platen Presses are the latest development in the reinforced plastic molding field. They are job engineered to help you meet all molding requirements, as well as speed production output, and reduce operating costs. Their all-steel construction with long tie rod bearings and larger diameter tie rods provide maximum rigidity to assure extremely accurate work with all types of plastic forms. Standard models are electric-hydraulic in operation and available in capacities from 25 tons to 600 tons. Write for Bulletin 405.

DAKE PRESSES

DAKE CORPORATION
648 Robbins Road
Grand Haven, Mich.

NEW FROM PLENCO



Palleted molding compounds for easier, low cost handling...

Do you know that PLENCO phenolic molding compounds are now available at no additional cost on expendable pallets? These pallets are 35" x 45" (holding 1500 lbs.), or 42" x 42" (holding 2000 lbs.), and you may specify the pallet size preferred by you.

Both are neat, uniform shipping units that can be safely stacked three high because all bags on each pallet are spot-bonded to each other, imparting unitized rigidity.

Palleted shipments reduce your direct labor handling cost. We have also added one other feature for easy inventory control and inventory status. We now stencil the material and batch numbers, color, flow, and customer's order number on the *sides* of the bag rather than the face. This makes identification easy and complete—with no need to climb on top of the load or remove a pallet to find out what's under it.

We don't expect a pat on the back for an idea as simple as this; but it does show that we are thinking in terms of your convenience when using PLENCO products.

a new convenience at no extra cost!

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

SINGER sews up a case with plastic!

To design their new portable sewing machine case, Singer Manufacturing Company needed a tough, lightweight material. They chose a new Koppers high-impact plastic . . . DYLENE® 400 polystyrene.

The case is exceptionally strong and weighs only five pounds! It's as compact as a small piece of luggage; easy to carry, easy to store, and it's attractive.

High-impact DYLENE polystyrene is strong, durable; it molds cleanly without sharp edges, eliminating costly secondary operations. It has a high surface gloss and smooth finish. DYLENE can take rough handling, it won't chip or break. DYLENE comes in a wide range of permanent colors.

Eight-foot giant weighs only 23 pounds

This towering store display, molded for Green Giant, is an absolute traffic-stopper. Because it's molded from lightweight DYLITE® expandable polystyrene, this 8-foot-high unit weighs only 23 pounds. DYLITE is strong, easy to mold to almost any size or contour, and easy to decorate. It's a natural for any molded part where three-dimensional detail is a must. The Green Giant was molded by Weber Plastics, Inc., Stevens Point, Wisconsin.

Plastic gives portable TV strong case against heat

Magnavox needed a high-impact, heat-resistant plastic for front and back pieces on their new 19″ portables, so they chose specially developed Koppers polystyrene —DYLENE® 800. This easy-to-mold plastic has exceptional strength, a heat distortion temperature of 195° F, and it meets all Underwriters Laboratory requirements. It molds to all colors in a glossy finish. Parts molded by Superior Plastics, Chicago, and Alma Plastics, Alma, Mich.

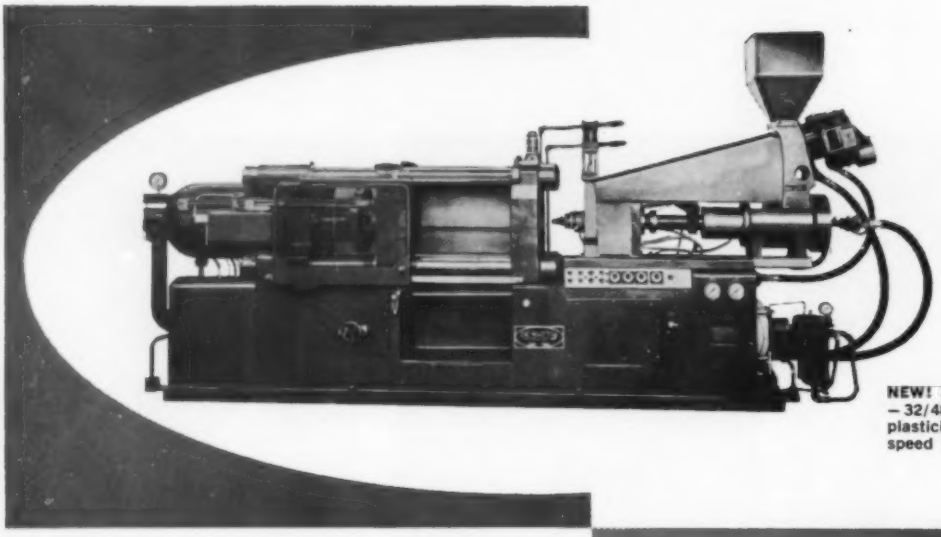
New spreader made from corrosion-proof plastic

This new lightweight Seymour spreader can dispense weed killers, insecticides, fertilizers, ice melters and seed, yet it never corrodes. The hopper is molded from tough SUPER DYLAN® high-density polyethylene. No need to worry if you drop it . . . it won't break. This spreader won't leak or absorb odors, and it's easy to keep clean. Spreader molded by Amos Molded Plastics, Edinburg, Ind. for Seymour Mfg. Co., Seymour, Indiana.

KOPPERS PLASTICS

Learn how Koppers family of fine plastics can improve your product at less cost. Contact Koppers Company, Inc., Plastics Division, Dept. 127, Pittsburgh 19, Pa.

KOPPERS®



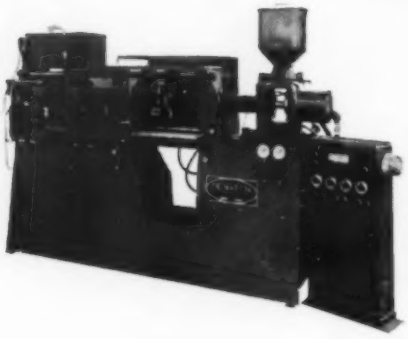
NEW! PREPLASTICIZER MODEL – 32/48-oz; 300 lbs./hr. plasticizing capacity; variable speed hydraulic screw drive.

INJECT PERFECTION IN YOUR MOLDING

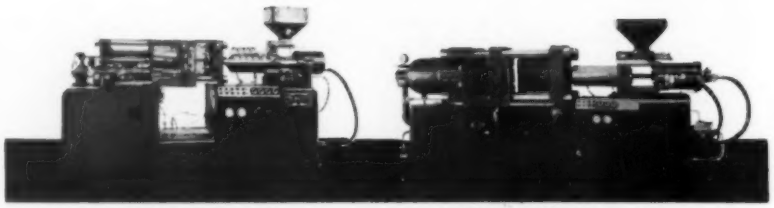
Give yourself every opportunity for better, faster, more profitable production with De Mattia injection molding machines.

From the brand-new *preplasticizer* model to the equally new and immediately accepted Model J 2-ounce, there is a De Mattia fully automatic, fully hydraulic machine to meet your specifications.

Send for complete data on the De Mattia line today.



NEW! 2-OZ. MODEL J – fastest fully hydraulic, fully automatic, molding machine ever built; only one of its kind in the world.



4/6-OZ. MODEL K-2 – the maximum in continuous, dependable, easy operation for record-breaking production at minimum cost.

12/16-OZ. MODEL M-2 – the standard for the industry, practically guarantees production increase up to 20%; 42" max. daylight; 400-ton clamp.

DE MATTIA

DE MATTIA MACHINE & TOOL CO. • **Main Office and Plant: CLIFTON, N. J.**

Sales Representatives: ACME MACHINERY & MANUFACTURING CO., INC., 500 Saw Mill River Rd., YONKERS, N. Y.; 102 Grove Street, WORCESTER, MASS.

COAT? LAMINATE? MOLD? VACUUM-FORM? Find out the advantages of Lantuck nonwoven fabrics!

Every year, more and more companies are discovering the remarkable advantages of vinyl-coated nonwoven fabrics. A major American automobile manufacturer, for example, used pre-formed door-panel skins of vinyl-coated Lantuck in '61 sports models. And they proved so outstanding in both appearance and performance that Lantuck has been specified for re-use in '62! Lantuck is made of fibers bonded together—and offers a combination of features impossible with woven or knit base fabrics. Moreover, it comes in many combinations of fibers and binders to produce precisely the characteristics desired. **Send in the coupon below...we'll show you how to add all these big advantages to the coated fabrics or coated-fabric products you produce!**

- **multi-directional stability**—random-fiber distribution for equal strength and stretch in all directions
- **formability**—adaptable for deep embossing and pre-forming
- **economy**—cuts processing costs, offers extra value in end-use performance
- **durability**—has outstanding tear and seam strength
- **smoothness**—flat surface has no weave to show through
- **processing advantages**—guides easily, adheres well, die-cuts cleanly

WELLINGTON SEARS CO. Dept. K-10-A
Lantuck Division, 111 W. 40th St., N. Y. 18

I am interested in learning about Lantuck for:

___ calender coating ___ molding
___ vinyl laminating ___ high-pressure laminating
___ vacuum forming ___ dielectric sealing

Name_____

Company_____

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LANTUCK quality bonded nonwoven fabrics

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NOW...

at competitive price...
induction-heated
water-cooled extruder

AETNA-STANDARD MODEL 150

Model 150 has the same superior design, same induction heating and water cooling features as the bigger, deluxe Aetna-Standard extruders. Delivers increased production (up to 1500 lbs./hr.) with less scrap on extrusion coating, laminating, blown film or flat film operations. 2½" to 6". 20:1 and 24:1 L/D ratios. Floor or carriage mounted.

We can make quick delivery on this popular machine. Write or call for more information. Ask for a free Plastics Weight Calculator... a new, advanced useful tool.

Black-Clawson Furnishes Complete "Packaged" Machine Lines, from unwind to winder, for Extrusion Coating and Blown Film.

HALE and KULLGREN PLASTICS DEPT.
DILTS DIVISION
613 E. Tallmadge Ave., Akron, Ohio

BLACK-CLAWSON

Got tough production requirements for molding reinforced plastics?

ERIE WILL BUILD THE PRESS

When you have difficult or unusual requirements in low pressure molding of reinforced plastics, an Erie hydraulic molding press may be the machine you need.

Both the conventional 4-rod type and the new welded frame design (illustrated) provide variable opening and closing speeds, adjustable stroke and adjustable press tonnages.

Erie hydraulic presses for reinforced plastics molding are designed and built to meet production requirements. Custom-designed presses can be manufactured to suit your specifications over a wide range of capacities: machines with capacities from 50 tons to 1,000 tons are operating successfully in many customer plants.

In addition, standard Erie hydraulic presses, with conventional die areas, are available in a range of capacities up to 750 tons.

Erie hydraulic presses are operated by semi-automatic control, and can be cycled manually for die set-up. Accurate control is provided to suit the material being molded.

For the complete story, write Erie Foundry Co., Erie, Pa.

ERIE **ERIE FOUNDRY COMPANY** ERIE, PA.

• Manufacturers of Forge Shop Machinery • Hydraulic Presses • Special Machines

General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

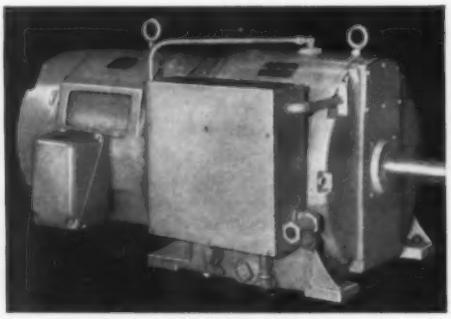
KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

KINATROL —a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

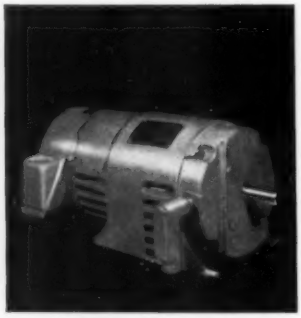
*Trademark of General Electric Company

821-07

AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP

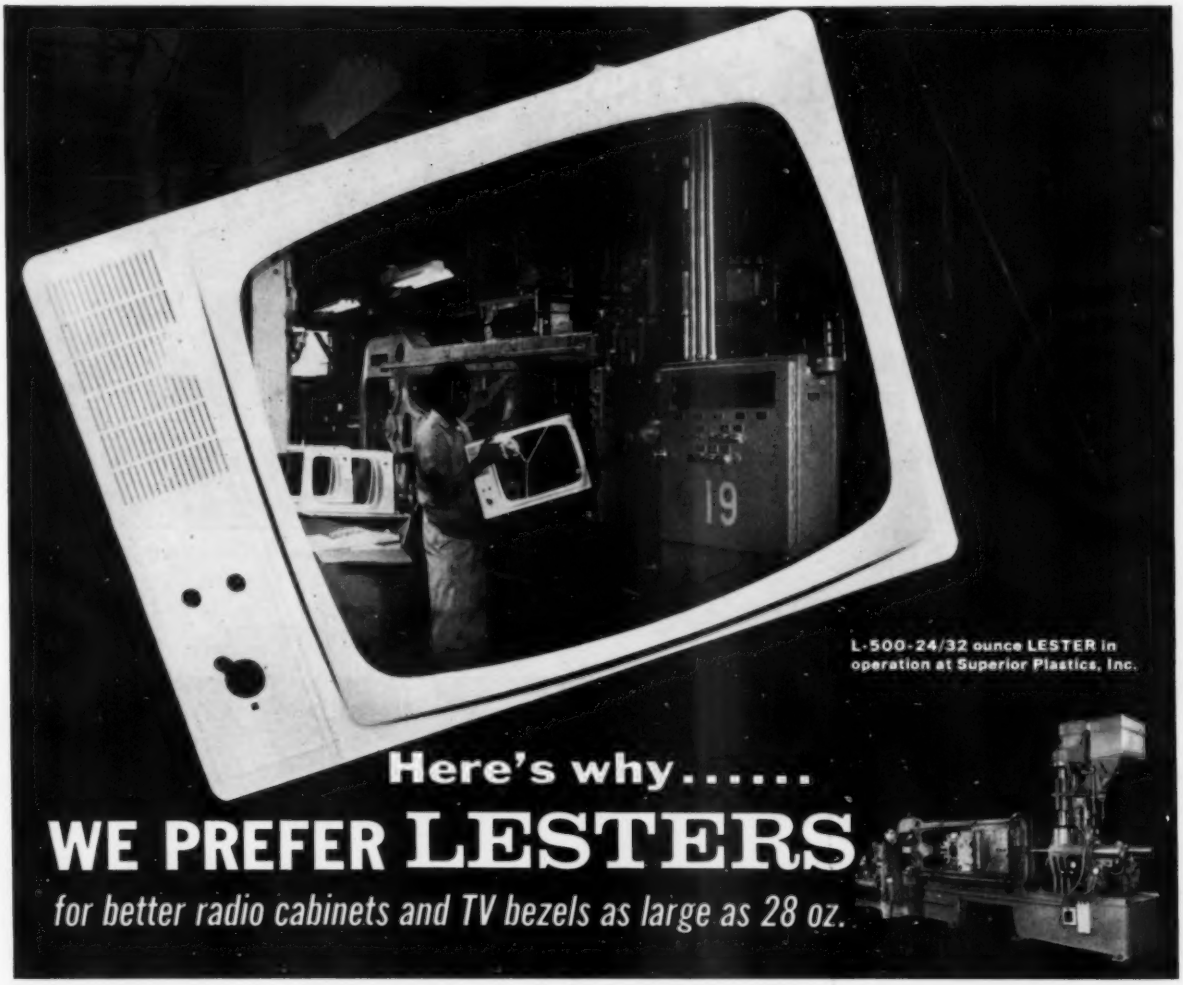


AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA



L-500-24/32 ounce LESTER in operation at Superior Plastics, Inc.

Here's why.....

WE PREFER LESTERS

for better radio cabinets and TV bezels as large as 28 oz.

"We have run over 280,000 of these TV bezels, weighing 26 ounces, on our 24/32 ounce Lester, at the rate of approximately 1250 pieces per day. This hi-heat, hi-impact polystyrene part must have a high glossy finish. Now here's why we prefer THE Lesters:

"For one thing, this part is produced with an exceptionally low rate of scrap. For another, our Lesters give us more hours of profitable service per year—we find them maintenance free equipment—and we run night and day, five or six days a week."

Roy Kinsey
Plant Manager
Superior Plastics, Inc.

Superior Plastics, Inc., in Chicago, does expert custom molding and extrusion of a wide range of quality work, including critical radio cabinet and TV bezels. Having faced every imaginable demand of injection and extrusion, and as a result of experiences such as that described here, Superior Plastics now has 11 Lesters out of the 22 machines in their shop—plus 6 extrusion machines and complete painting and finishing facilities.

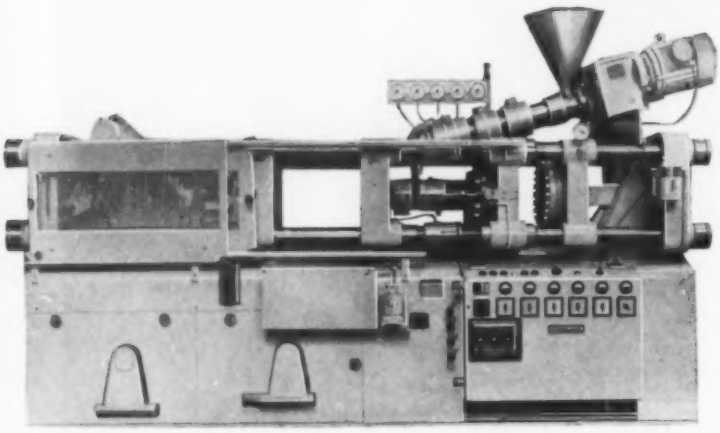
For a detailed description of the complete line of Lester Injection Molding Machines from 2/3 ounces to 24/32 ounces, write today for Bulletin 204-A.

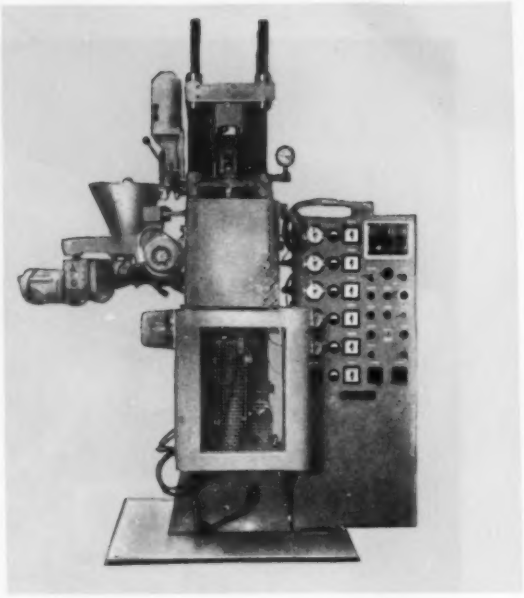
LESTER INJECTION MOLDING MACHINES

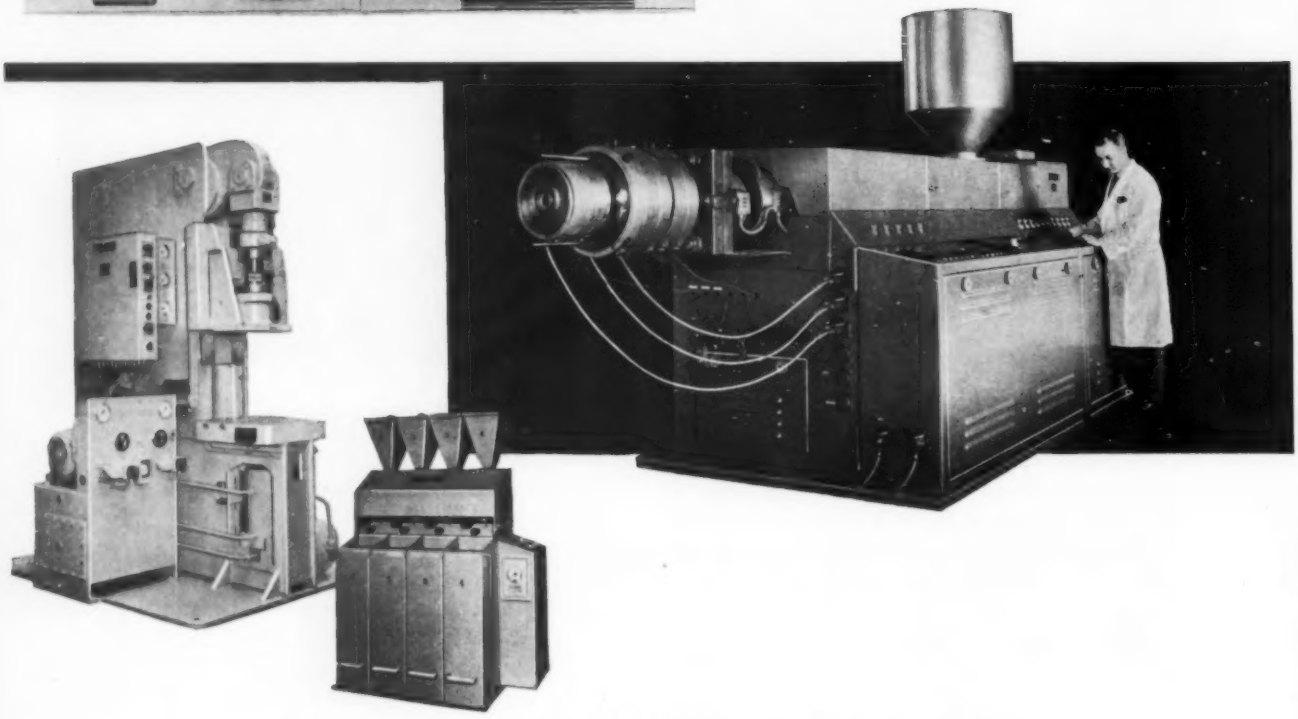
Distributed by **Lester-Phoenix, Inc. • 2621-N Church Avenue • Cleveland 13, Ohio**

Agents in principal cities throughout the world

A PROGRAM FOR ALL DEMANDS





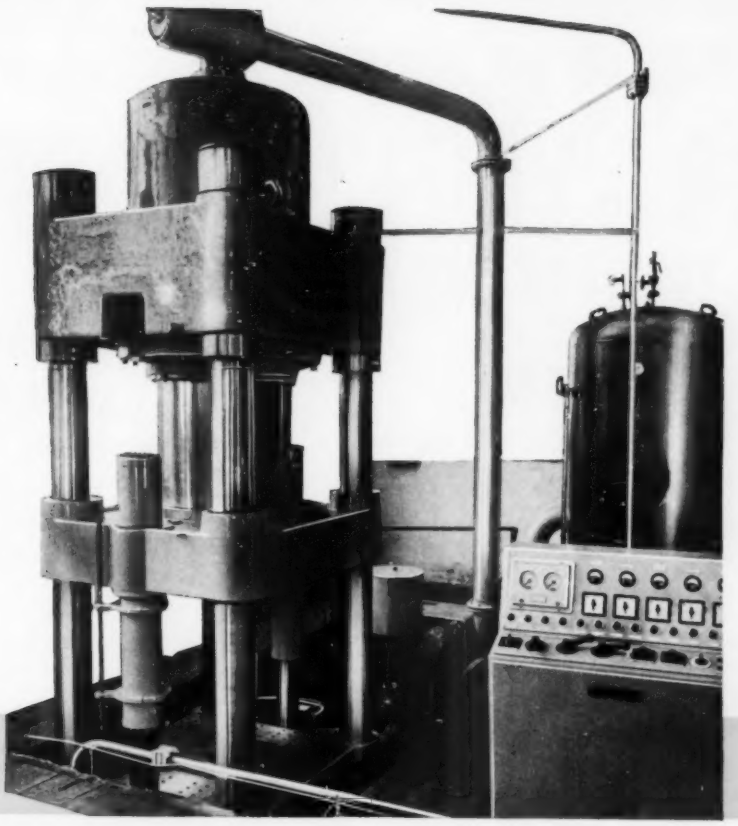


The progressive application of plastics in industry and trade requires efficient processing machines. Battenfeld automatic machines meet these requirements and impress by reliability and economical production. We are pleased to inform you of our manufacturing program and to assist you in solving all your production problems.

Main Office and Plant

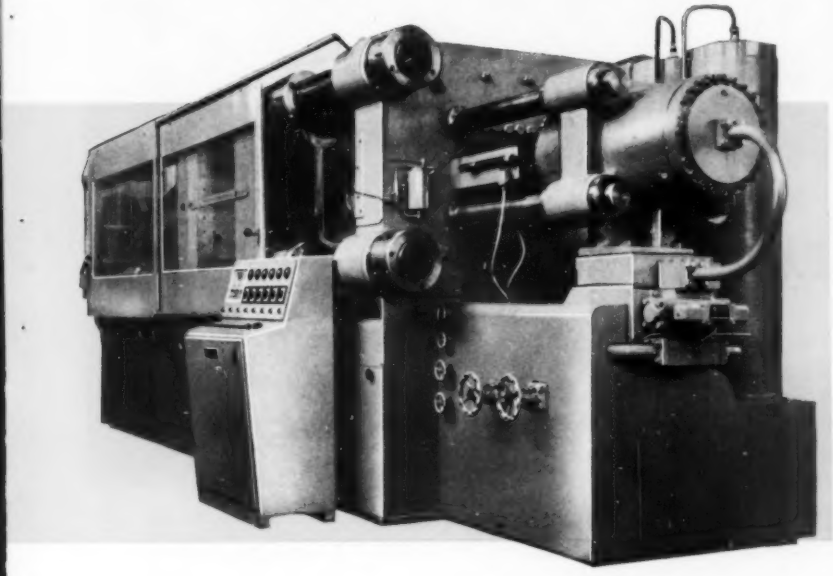
BATTENFELD MASCHINENFABRIKEN GMBH

Meinerzhagen/Westf., GERMANY



BATTENFELD

MACHINES FOR PROCESSING OF ALL PLASTIC MATERIAL



More than 7000 Battenfeld automatic injection molding machines are in operation in 67 countries all over the world. This figure evidences the confidence in our machines and is a proof for the capacity of our production plants.

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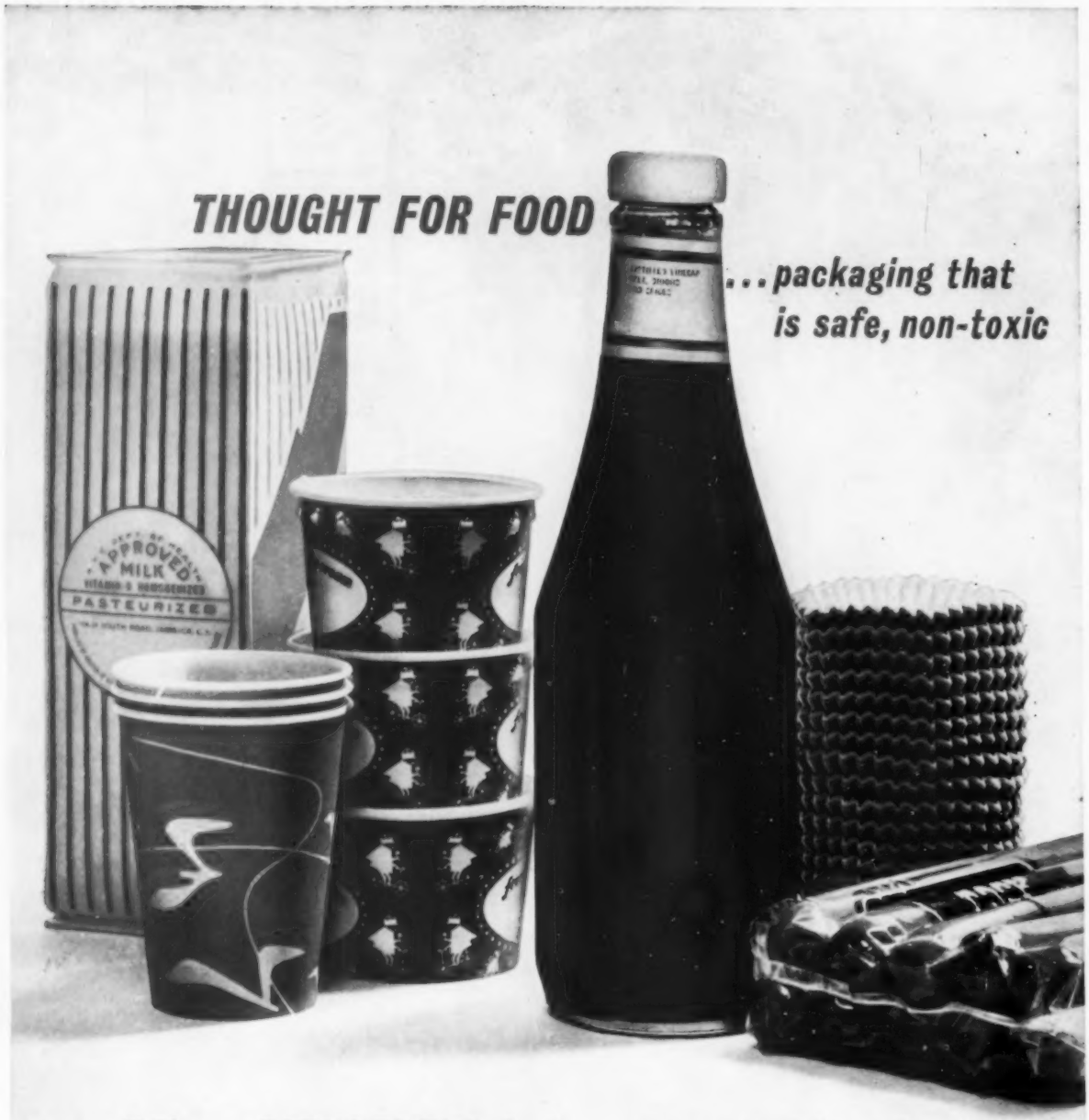

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The rapid development of new multiple component finishes, coatings and build-up materials demands advanced equipment for proportioning and spraying (or pouring) them. Binks Formulator and Turbulator Gun answers this need.

Binks Turbulator Gun will handle the fastest reacting materials without clogging. It's a high energy internal mixer designed for hand or automatic spraying or pouring of mixed components up to 10 lbs. per minute. The gun blends materials from 1 to 50,000 cps . . . permits staged introduction of plural reactants . . . mixes slurries and semi-solids. And, it is easily cleaned and operated by non-skilled workers.

Binks Formulators automatically proportion two resins and deliver them as separate fluid streams to the Turbulator Gun. Formulators are air operated and pump directly from original 1- to 55-gallon containers. Ask about a demonstration.

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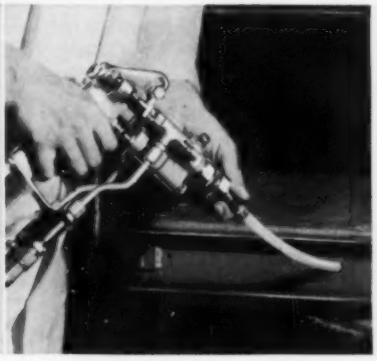
Insulate a seven room house with plastic foam (left) in an 8-hour day using Binks equipment. The Formulator (lower left) handles resins up to 50,000 cps without heating. Pouring of component materials (lower right) is also an easy process with a Binks Formulator and Turbulator Gun.



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THE PLASTISCOPE*

News and interpretations of the news — By R. L. Van Boskirk

Section 1 — **October 1961**

Activity in methacrylates indicates a growing market

Although there has been little sensationalism in the growth of methyl methacrylate (MM) for the past year there have been several interesting advances that warrant particular attention to this material which is generally recognized as the most beautiful and most immune to outdoor weathering of any thermoplastic.

Latest development is the introduction by Rohm & Haas of a new formulation of Implex, a heretofore opaque high-impact, modified MM that has been steadily expanding its penetration into the so-called 40-to-70¢ engineered molding materials markets. All Implex formulations sell for $0.465 in natural color and quantity lots (20,000 lb.); standard colors are $0.485. The new formulation, Implex R, is most unusual for a modified impact material in that it has a high degree of transparency—it has a 76% light transmittance in 0.125-in. thickness. And yet it has double the highest impact strength available in previous formulations as well as vastly increased color scope. Like all other Implex formulations it is dimensionally stable, has low water absorption, is chemically resistant (including lipstick stains), is color stable, free of odor or taste. Its specific growth is 1.08; other Implex formulations range from 1.12 to 1.18. Its suggested uses include housings for machines and appliances, radio and television receivers, automotive arm rests, telephones, knobs, business machine keys, toys, sporting goods, etc.

The other four Implex formulations are A for impact; B for high gloss, better flow and moderate impact; C for maximum stain and abrasion resistance with moderate impact; and F for high heat distortion and moderate impact for use in vending machine canisters or in receptacles containing beverages, powdered cream, etc. It has received National Sanitation Foundation approval for pipe used for potable water. Like all other thermoplastics, these various formulations are required to meet the different needs desired by the user.

Rohm & Haas has also announced a new cast MM sheet size, 60 by 120 in., to expand its line of large sheets, which also include dimensions of 102 by 144 in. and a 96- by 144-inch. The broad range of large sheet sizes in various colors reduce sign manufacturing costs by permitting more economical cutting. As evidence of its faith in an expanding market for MM sheeting, Rohm & Haas has just finished expanding its casting operations at Knoxville, Tenn.

Another compartively new MM by Rohm & Haas is Tuffak, a flexible, tough sheet as thin as 0.050 inch. It will be discussed in more detail later.

New MM sheet producer

Borne-Lite Corp., Landover, Md., a subsidiary of Borne Chemical Co., is now in commercial production of Monocite cast MM sheet for the fabricating, lighting, and sign industries. The firm claims to be the first to offer panels up to 72 by 96 in. in color, without surcharges. The plant has been designed with special facilities so that it may specialize on individual orders. Production is expected to be over 1 million lb. this year, rising ultimately to the plant's 6-million-lb. capacity.

Monocite is a trademark coined by Du Pont for use by firms who cast Du Pont MM monomer according to standards set by the pro-

*Reg. U.S. Pat. Off.

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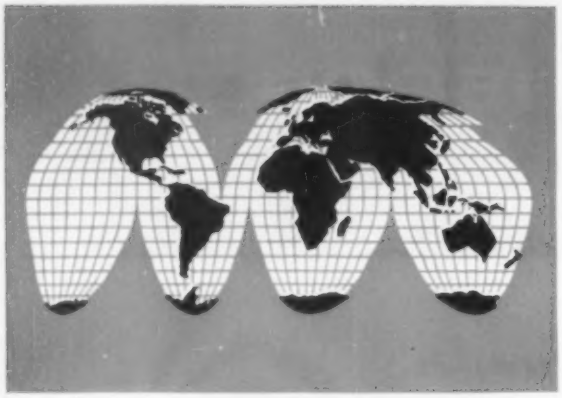

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Wherever in the world you are, Ferro is not far away . . . with a complete line of colorants and services that get you into production fast. You can depend upon Ferro color-matches — for Ferro knows plastics, and its colorants are consistently uniform and stable. Write for detailed literature! See list below for nearest Ferro Color Service.

THERMOPLASTIC RESIN COLORANTS

Dry Colors — Now, with Ferro Dry Colors, you can successfully dry color all types of thermoplastic resins in your plant. This enables you to reduce inventory, cut material waste, lower your coloring cost.

Dustless Dry Colors — Ferro's new line of nondusting pigments enables you to color granular thermoplastic resins easily and with a minimum of dust contamination. These new colorants are truly dustless . . . adhere better to the granules and improve color dispersion. Now dry coloring is possible with the cleanliness previously available only in premium priced pre-colored resins or color concentrates.

Dry Coloring with Ferro PrePaks — The need for weighing and handling colors is eliminated with the PrePak system. Available in PrePak weights to suit your production requirements, the use of PrePaks contributes to plant cleanliness . . . and reduces the hazards of color contamination. It also adds convenience to your color-mixing operation and lessens the chance of error.

THERMOSETTING RESIN COLORANTS

Polyester Color Gelcoats — You have a complete line selection of colored gelcoats for reinforced plastics. Ferro gelcoats produce smooth, high-gloss colored surfaces that will not absorb water . . . resist cracking and abrasion. The gelcoat line includes fire-resistant and boat-interior coatings. Color chart available. Special colors to your specifications.

Polyester and Epoxy Pastes — Easy stir-in coloring of the liquid polyester and epoxy resins is possible with Ferro's color pastes. The concentrates provide the highest pigment concentration ground into a 100% liquid epoxy resin or, in the case of polyester concentrates, ground into a reactive polyester resin. Extreme care has been taken to use only pigments with the utmost in stability in these two lines. Samples and color charts available.

HIGH-TEMPERATURE RESIN COLORANTS

Inorganic Pigments — Ideal for use in all plastic resins. They are extremely heat resistant and will withstand attack by acids, alkalies and weather conditions. Because of these and other important properties, they are finding wide acceptance in the new high-temperature resins. Color chart available.

Purified Pigments for Fluorine Resins — A new line developed especially for fluorine resins, these pigments contain an absolute minimum of soluble salts. For this reason they have superior electrical properties and are very easy to disperse.

Silicone Color Concentrates — Specifically designed for use in silicone rubber. Ferro inorganic pigments are preground into a low-viscosity, silicone, gum-stock carrier, substantially reducing the time required for grinding or other processing during molding. This also reduces dusting and cleanout time saving. The standard line of Ferro inorganic pigments is also excellent for use in silicone paint compounds. Color samples available.

COLOR SPECKLES

For producing "salt and pepper" effects in plastic resins. They are available in five colors . . . in large or small speckles, thermoplastic or thermoset.

For further information on any of these plastic colors, write the Ferro Color Service Center nearest you. Cleveland 5, Ohio, 4150 East 56th St. • Los Angeles 22, Calif., 5309 S. District Blvd. • Elizabeth, N. J., 107 Trumbull St. • N. Miami Beach 69, Fla., 1020 N. W. 163 Drive.

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ducer. Du Pont has had no MM sheet casting facilities of its own since shortly after the war.

Another MM casting plant expands

Cast Optics Corp., Hackensack, N. J., a producer of MM cast sheet for 15 years, has added a new "automated" casting facility that will produce 7 million lb. of sheeting yearly. Automation could be an exceedingly important factor in MM casting, since there has always been a great amount of hand labor involved that results in comparatively slow production rates. This is Cast Optic's third expansion in the last six years.

New MM plant to produce in 1962

American Cyanamid has stated that its new MM molding material plant is scheduled to come into production in mid-1962 at Wallingford, Conn. The material will be produced under a license from I.C.I. of Great Britain. American Cyanamid purchased Wasco Chemical, Cambridge, Mass., last spring and will operate it as a division of the parent company. Wasco is primarily a producer of cast MM sheet under the tradename of Acrylite, with plants at Cambridge; Sanford, Me.; Kearny, N. J.; and Toronto, Canada, and claims to be the second-largest producer of MM sheet in the United States. The company also operates True-Scale Inc., producer of fiber-reinforced plastics in Wichita. In addition, its Wasco Consolidated S.A., a Swiss corporation located in Geneva, has joined with two British firms in the development of a new plastic printing plate.

Other methacrylate developments

Escambia Chemical has made no recent announcements but is operating a pilot plant to produce MM at Pensacola, Fla. There has as yet been no word on the selection of a site to build a commercial plant, but it will probably be located near a source for isobutylene, since the company's new process is based on that material. It is believed that the firm will concentrate on coatings rather than plastics materials.

U. S. Plastic and Chemical Corp., Metuchen, N. J., long-time producer of MM sheet for buttons, has developed an improved material under the tradename of Lustrelite. The new sheet is said to produce buttons with improved resistance to dry-cleaning solvent and heat, more brilliance, and better dyeing results.

Commercial Plastics of Florida's newly expanded quarters for the Florida Boat Shield Co. of Jacksonville, Fla. (formerly in Starke, Fla.), will give Commercial Plastics & Supply Corp. of New York a major division for fabrication and distribution of MM as well as other plastics. The parent company's only other fabricating plant has been Comco Plastics in Richmond Hill, N. Y.

Owens-Corning Fiberglas announced some time ago that the company would produce fibrous glass-reinforced panels using Du Pont's Lucite Sirup as the bonding resin in order to give its customers a material that will withstand longer and more severe weathering exposure. **U. S. Rubber** has been distributing for some time such a material, produced by Russell Reinforced Plastics Corp., Lindenhurst, N. Y.

Goodyear Aircraft Corp. is investigating the possible applications for

where quality is a matter of life or death

In the manufacture of medical tubing there is no margin for error . . . human lives hang in the balance. That is why manufacturers of medical tubing and apparatus have adopted VYGEN 120 . . . the quality PVC resin that satisfies the rigid government specifications. VYGEN 120 is not just another quality resin, but one of a family of specialized resins developed and manufactured to meet the requirements of the processor and the demands of the end product. No matter what your processing requirement, you should look to the VYGEN family of PVC resins just right for every application. For complete information call or write us today!

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VYGEN 85 — Recommended for calendering, extrusion and molding operations where processing at low temperatures is desired.

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its stretched methacrylate sheet for non-aeronautical uses. It now goes primarily into windows, canopies, and windshields of jet airplanes.

AviSun unveils 100-million-lb. PP plant

Dedication of AviSun's new facility at New Castle, Del., revealed the first complete 100-million-lb. plant for PP in the world. Other companies are approaching (or possibly surpassing) this mark by adding 40- or 50-million-lb. units at a time. Since the total PP consumed in 1961 is not expected to be over 80 million lb., they are waiting until the market develops. The AviSun plant is adjacent to its 10-million-lb. cast PP film plant where Olefane film is now being produced for bread wrapping and other uses. Oriented film is now also made in this facility.

American Viscose joined with Sun Oil to create AviSun in 1959. The two had both been developing PP independently—one specializing in film and fiber, and the other in molding and extrusion materials.

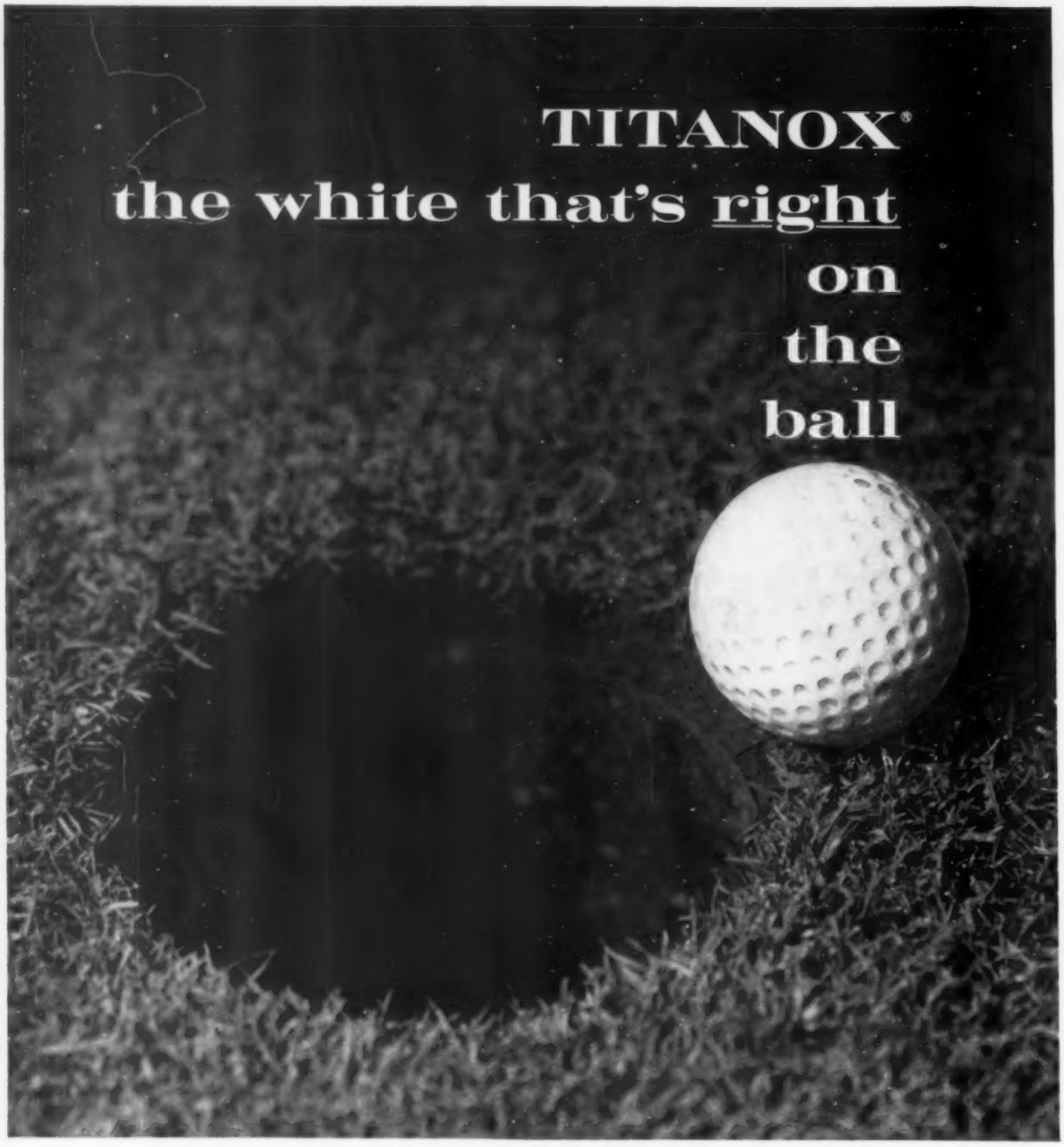
Previous to the dedication, AviSun had announced four new impact molding grades, with each offering a step-up in impact strength at room temperature. In one grade, low-temperature impact strength is retained down to −10° F. Prices for the new higher impact grades are 44 and 45¢/lb.—regular PP is 42 cents. One of the new grades is suggested especially for bottles.

The company has also announced a new modified PP that sells for 36 cents. The filler has not been specified. It is a blue-gray molding resin with high rigidity and heat distortion values, good dimensional stability, and good creep resistance. It is suggested particularly for electrical components and automotive parts.

Oil company acquires plastics-chemical firm

When Atlantic Refining purchased J. P. Frank Chemical it represented further evidence of the fact that nearly all petroleum companies are determined to enter the finished plastics area come hell or high water. Apparently over-capacity and low profits mean little to them—they are accustomed to it in their own field. They have the money to invest and the chemical industry is a natural outlet for their products. Some of the old-timers no doubt also have been shocked to find that more profit can be made by selling chemicals in quarts than by selling oil or gasoline in barrels. On the other hand, it also seems that top management in petroleum companies has difficulty in realizing that plastics isn't sold like gasoline. For example they stew over the necessity for hiring a large crew of men to handle technical service for customers—this service is provided for oil companies by service men in gasoline stations. The chemical men in petroleum companies understand this need, but management is often hard to convince. Nevertheless the oil companies are determined to move in—furthermore they know that a "one-plastics" operation is seldom profitable and it can be expected to branch out into a variety of materials. In the meantime, chemical or plastics producers are also moving into petroleum company alliances in order to secure their supply lines. As a result, it won't be long before petroleum companies become major plastics suppliers and chemical companies may well be in the petroleum business.

The acquisition of majority interest in Frank by Atlantic, with the retention of present management, gives Atlantic Refining Co. plastics know-how but it will take time for adjustment. A resultant move may well be production of



To give their products outstanding visibility on the fairway and at the sales counter, golf-ball manufacturers rely, among other things, on an unbeatable threesome that includes the right compounding ingredients, the right vulcanizing conditions and the right TITANOX pigments.

These white titanium dioxide pigments are ideal for whitening and brightening golf balls—from the raw material used for cover stock to the final bright coating applied to the finished ball.

As it is with golf balls, so it is with a wide range of other rubber and plastic products—there's a TITANOX white pigment to do the job efficiently. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y. In Canada: Canadian Titanium Pigments Ltd., Montreal.

TITANIUM PIGMENT CORPORATION
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TITANOX

6993

its own vinyl chloride monomer despite today's burdensome over-capacity. Frank is a completely integrated company (except for monomer) from polymer and plasticizer to finished goods for the converter, but also sells a large portion of its resin to other processors. It is no secret that the company has long recognized the necessity for expansion of its resin facilities in order to obtain larger sales volume and has apparently found a willing cooperator to provide the needed capital.

Prediction for '66: 600 million lb. of foam

In a remarkable survey of the foam market given at a recent meeting of the American Institute of Chemical Engineers, John C. Tallman of Du Pont's Marketing Research Division predicted that total plastics foam consumption in 1966 would be 620 million lb., of which 275 million would be flexible and 345 would be rigid or semi-rigid, the latter including non-resilient insulating materials and semi-resilient foams such as the polyolefins. The separation into various materials is as follows: for flexible foams—polyurethanes, 235 million lb.; PVC, 35 million; others 5 million; for rigid foams—polystyrene, 130 million; polyurethanes, 130 million; polyolefins, 35 million; polyepoxies, 20 million; PVC, 20 million; phenolic, 5 million; others, 5 million. Estimates for 1961 for flexible plastics foams are: polyurethanes, 100 million lb.; PVC, 10 million; others, 2 million. Rigids are primarily: polystyrene, 60 million lb.; urethane, 15 million; PVC, 2 million; and various miscellaneous quantities of other plastics.

Mr. Tallman's estimate on PVC is especially remarkable since no one has been willing to go out on a limb in predicting its possibilities. He separates PVC foam into the following principal end uses: furniture, 10 million lb.; automotive, 15 million (laminates with vinyl sheet or fabric are included in automotive, with an additional 5 million lb. for handbags and luggage); insulation for piping and equipment, 3 million; foamed wire insulation, 10 million; flotation products, 4 million; and miscellaneous, 8 million lb. and perhaps much larger. His estimate on foamed vinyl for textile use in outerwear garments supposedly includes laminates.

Where will foam be used?

In 1966 Mr. Tallman expects to see 80 million lb. of urethane in furniture, 60 million in bedding, 15 million in carpet cushioning. He thinks urethane automotive cushioning will go to 40 million lb. in 1966, or double the 1961 use—other automotive use may be 25 million lb. in 1966. Textile laminates for outerwear use should be at least 15 million lb. in 1966—may well be much more, but vinyl may move in for part of that market. Mr. Tallman predicted that the building industry alone will consume 55 million lb. of rigid polystyrene and 30 million lb. of rigid urethane in 1966 (potential market in construction is over a billion pounds). Various forms of insulation will consume most of the rest of the 620-million-lb. total for 1966. Packaging he lists as using 5 million lb. of flexible urethane, 5 million of rigid urethane, 15 million of polystyrene, 5 million of polyolefins. The epoxy estimate of 20 million for 1966 includes low-temperature insulation such as warehouses, refrigerators, transport, etc., and piping.

Mr. Tallman also pointed out that over-capacity in flexible urethane is already a problem—there is already enough to supply potential demand in 1966.

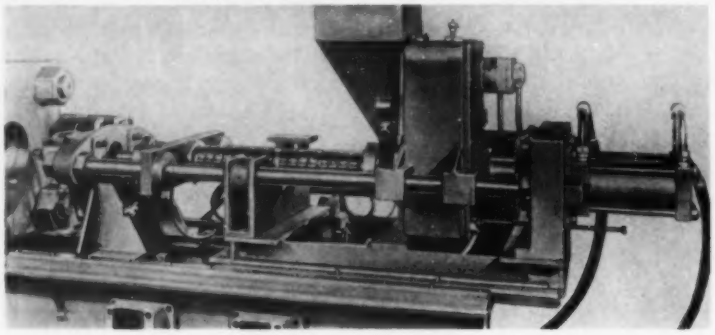
For additional and more detailed news see Section 2, starting on p. 232

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

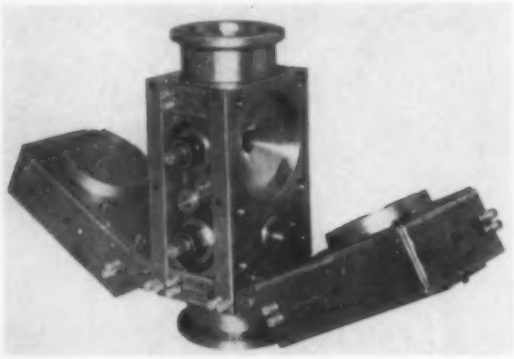
Injection machine is equipped with in-line screw preplastication

The Farrell Watson-Stillman S-20-350 injection machine is equipped with in-line screw preplastication. However, it is not to be confused with reciprocating-screw machines. In this unit, the screw does not reciprocate within the cylinder, as it does in conventional screw-ram machines. Injection takes place as the extruder barrel rides over a hollow, stationary ram which telescopes into its forward end. Material is forced from the extruder barrel through the axial hole in the stationary ram and into the mold. This simplifies the screw drive, since it need only provide for rotating the screw rather than simultaneously rotating and reciprocating the screw. An hydraulic motor powers the screw and provides for stepless variation of screw speed. Maximum shot capacity is 20 oz. (styrene) and plasticating capacity is 210 lb./hr. on a 5-in. injection stroke. Maximum speed ranges between 700 and 900 cycles per hour. Maximum injection pressure is 20,000 p.s.i. using a 2000 p.s.i. hydraulic pressure. Clamp capacity is 350 tons and clamp stroke is 24 in.; minimum die thickness is 8 in. and molds up to 20½ by 35 in. may be handled. Daylight opening is 32 inches. Rated maximum power consumption of heater units is 32.3 kw. *Farrell-Birmingham Co. Inc., Watson-Stillman Press Div., 565 Blossom Rd., Rochester 10, N. Y.*



Extrusion screen changer

The Sterling Automatic Screen Changer consists of three sections: main body and two sides, each side containing the breaker plate and screen pack. An adaptor at each end of the body is used to mount the screen changer between the extruder and the die. Resin entering from the extruder is diverted by a valve in the center section to either the right or left hinged leg; whichever one has the clean screen pack. The material flows through the hinged section through streamlined channels where a second valve channels it to the die, keeping it out of the other side. While one side is in use, a clean screen pack is inserted into the other side. *Sterling Extruder Corp., 1537 W. Elizabeth Ave., Linden, N. J.*



Hopper-drier units

Newly redesigned blower units and drying hoppers are now available from Thoreson-McCosh. The blower units contain new and quieter blowers. Hoppers are available with split and hinged tops which facilitate cleaning. All hoppers are designed to permit free and uniform air flow through the material and are dust-tight, with special permanent filters in the lids. All units are built on a semi-custom basis to suit the output of the machine requiring the hopper drier unit. Hoppers have sight glasses to monitor level of material. *Thoreson-McCosh Inc., 18208 W. McNichols Rd., Detroit 19, Mich.*

Hot-air welding tool

Designated the Leister Model LPS, this electro-hot-air unit is designed for welding most thermoplastics. Weighing only 1 lb., the device can use air from the regular supply system or from special blowers which are available. A replaceable plug-in heating element simplifies repair and changing of ranges for very-high-temperature operation. Ordinary-temperature range changes are made by a switch on the handle; exact adjustments are made by regulating the air supply. A thermostat protects the tool against operation without air. Supplied with vinyl air hose and extra nozzles, the unit is priced $49.50 F.O.B. Newark. Both 110- and 220-v. models available from stock. *Weldotron Corp., 907 Frelinghuysen Ave., Newark 14, N. J.*

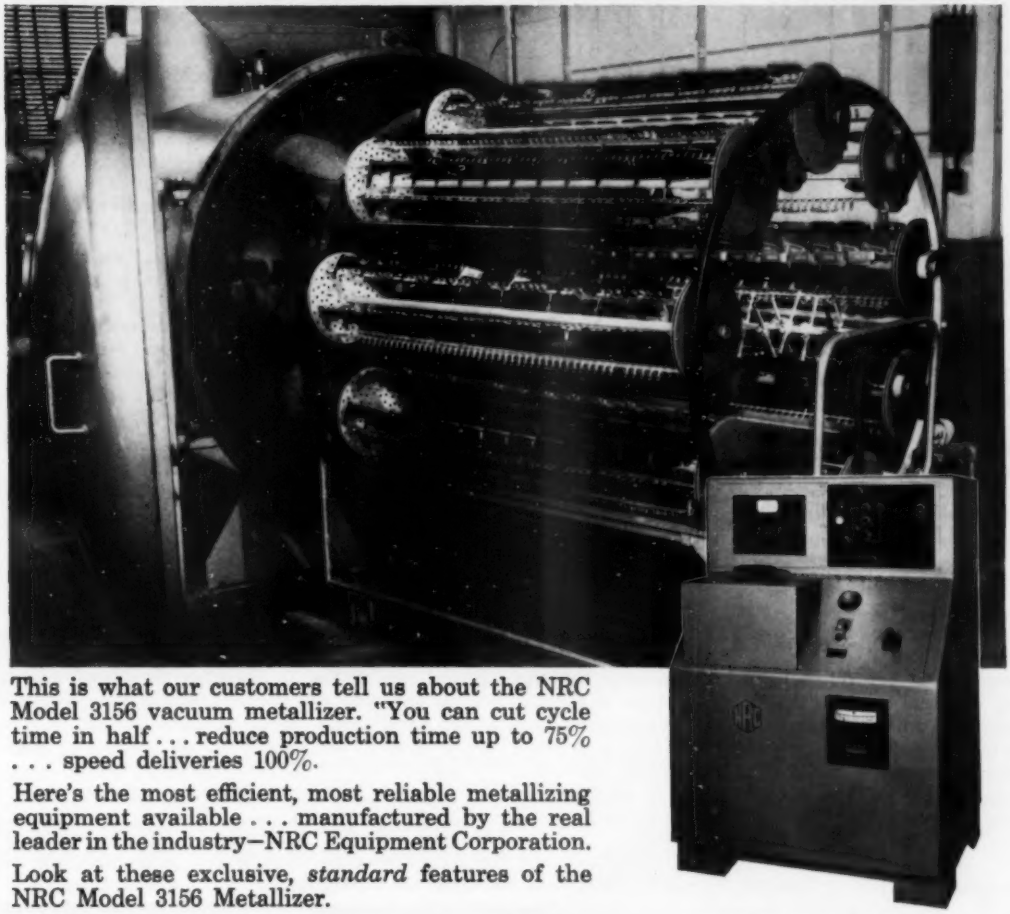
One-point control for 3-roll mill

High-speed 3-roll mills in all sizes from 4½ by 10 in. to 16 by 40 in. are now available with one-point hydraulic adjustment of roll spacing and pressure-recording gages. Designed for operations using a floating center roll, the single-point adjustment, as contrasted to the conventional four-point adjustment on regular mills, is said to reduce

* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of **Modern Plastics** do not warrant and do not assume any responsibility whatsoever for the correctness of the same or otherwise.

FAST

VACUUM METALLIZING CYCLES



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Here's the most efficient, most reliable metallizing equipment available . . . manufactured by the real leader in the industry—NRC Equipment Corporation.

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MANUFACTURING PLANTS AT NEWTON, MASSACHUSETTS AND PALO ALTO, CALIFORNIA

Specifications and claims are those of the manufacturers and/or their agents.

set-up time and cut cleaning time in half. Special equalizers maintain equal pressure and parallelism between the rolls, assuring uniform mixing action. A special overload system is built into the machine to prevent damage from foreign matter. *Charles Ross & Son Co., 148-156 Classon Ave., Brooklyn 5, N. Y.*

Radiation pyrometer

The "Kustotherm" surface radiation pyrometer measures the temperature of plastics without contacting them, making it useful in moving film and other processes. It can be used on any color surface, including white, within the limit of permissible error. The head can be swivelled and

directed against vertical, horizontal, or slanted surfaces. The minimum diameter of the measuring surface is 2½ in. at a distance of ½ inch. Range of the instrument is 125 to 480° F. subdivided into two ranges. Readings take about 4 sec. and instrument operates without external power. *Epic Inc., 150 Nassau St., New York 38, N. Y.*

Color dispersion disks

Ferro- and Eastman-type dry color dispersion disks may now be ordered from stock for immediate delivery. Both models have a single 0.035-in. hole with a radius type cut or dish. The Eastman disk is inserted between the nozzle and nozzle seat and pinched in place by the nozzle. The Ferro disk is designed to be set into a ¾-in.-diam. recess, ⅝-in. deep, cut in the back of the nozzle, allowing full engagement of the nozzle threads and minimizing danger of damage to the nozzle seat. Ferro disks may also be used in pairs; used in this way they form a spherical inner chamber where mixing takes place as the plastic flows through the combination. Normally the plugs are used with the dished face downstream. Holes larger or smaller than 0.035 in. are available on special order in a few days. *Injection Molders Supply Co., 17601 South Miles Rd., Cleveland 28, Ohio.*

Reactive resin dispenser

The Mark II/25 shot-type machine can dispense by push-button one or more shots of mixed epoxies, polyesters, polyurethanes, and other reactive resins on demand. The unit is a plunger-piston pump machine in which two pumps are driven simultaneously by an air motor at required rates to proportion properly resin and hardener fed to the mixing head. Shot capacity is 25 cc. in any resin-hardener ratio between 1:1 and 1:25, with a ratio error of less than 0.1% at pressures up to 5000 p.s.i.g. The unit will handle resin viscosities from 10 to 50,000 centipoises. *The Leal Corp., P. O. Box 53, Oaklyn 6, N. J.*

Miniaturized temperature control

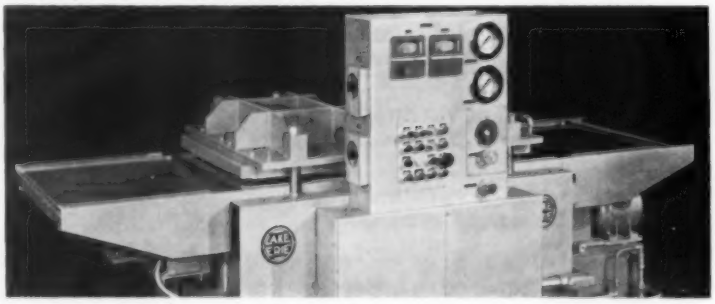
Measuring 4¼ in. wide, 4 in. high, and 5½ in. deep, the Model 450 Temp-Tendor automatic temperature control is useful where space is at a premium. In one case the instruments have been mounted in formerly unutilized spaces on the injection machine itself. Through anticipatory action, the controller maintains temperature to an accuracy of ±0.5% of full scale. Unit is available in 0 to 300, 0 to 500, 0 to 650, 0 to 750° F., as well as other standard and special ranges on request. Load contact capacity is 5 a., 115/230 v. a.c. (non-inductive). Through 1000° F. iron-constantan thermocouples are used. Price: $185. each. (Quantity discounts on large lots.) *Assembly Products Inc., Chesterland, Ohio.*

Hand resin dispenser

Called the Epoxer, this tool is designed to dispense minute drops or beads of epoxy adhesives and potting compounds. Once filled with the material and charged with pressure to force the material from the dispenser nozzle, the amount and rate of flow is controlled by a finger-tip action on the discharge end. Viscosities from a watery consistency to heavy pastes can be handled; materials may be filled or unfilled. All components are reusable or replaceable. Unit is about 6 in. long and about 1½ in. in diameter. Units are available from stock at $48 each. *Kenics Corp., P. O. Box 27, Greenwood Sta., Wakefield, Mass.*

Two-station thermoplastic compression press handles shallow molds

Developed for the molding of shallow thermoplastic items, such as printing plates, using a thermoplastic sheet feed, this machine consists of two 20-ton, down-stroke compression presses mounted on the same base. In operation, a sheet is placed in the machine and automatically moved between the platens of the first press where it is pre-heated and then molded under heat and pressure. After the sheet has been molded, the press opens and the sheet is conveyed to the second, or cooling, press where it is again clamped for cooling. While this sheet is cooling, the next sheet is being molded in the first press. After the first sheet has cooled it is automatically ejected, and replaced by the second molded sheet, while another

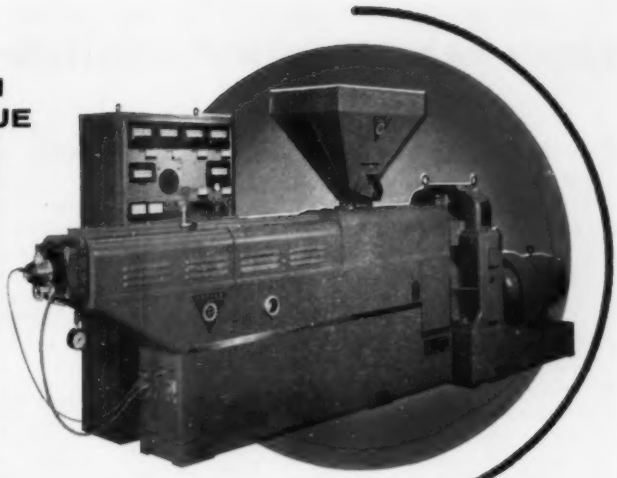


sheet is being molded. Platen area and the area of the loading and unloading stations will accommodate sheets up to 31 by 25 inches. Daylight and stroke of both presses is 2 inches. Press operates automatically as long as it is fed. Platens to be heated to 375° F. normal operating temperature. *Lake Erie Mach. Corp., Box 68, Buffalo 17, N. Y.* **(More on p. 48)**

Years Ahead!

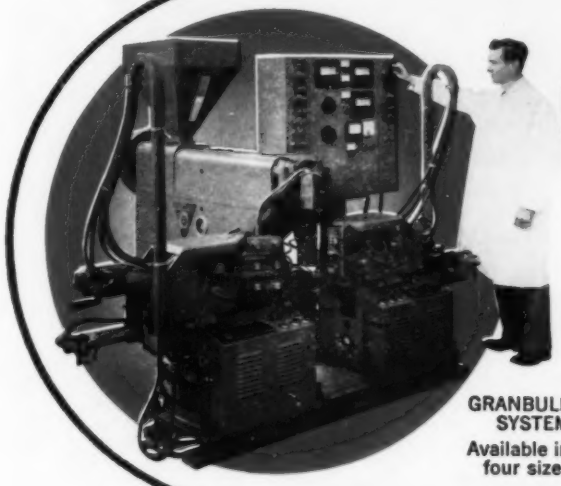
PRODEX HIGH TORQUE EXTRUDERS

with CHANGE GEARS



now permit you to select quickly the optimum reduction ratio and screw speed necessary to extrude **either high or low viscosity materials** at maximum horsepower efficiency and highest possible production rate for each extrusion job.

Prodex extruders give you the best possible machine return on your investment of any extruders in the world today. These machines are built vented or non-vented in a complete range from 1¾" to 10".



GRANBULL SYSTEM
Available in four sizes

PRODEX FULLY AUTOMATIC BLOW MOLDERS

For small parts—up to 2 gal.—a toggle clamp mechanism is used to develop high pressures and high speed action. A continuous parison flow from a single head feeds up to four mold clamps, resulting in extreme uniformity of parts. The highly streamlined head permits use with all polymers, including rigid PVC.

For large parts—5 to 55 gal.—an accumulator system allows fast extrusion of large parisons, with precise shot metering and uniform temperature throughout the parison prior to blowing.

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Resin Dryblending • Pigment Dispersion • Mechanical Heating • Vacuum Drying of resins and compounds in EXTREMELY SHORT CYCLES WITH EXCELLENT UNIFORMITY!

Both laboratory and high production units are now available with capacities from a few lbs. to thousands of lbs./hr. • They can be cleaned quickly and easily. • All contacting surfaces are stainless steel. • Vacuum tight construction is available for vacuum extraction. • Loads and discharges while running.

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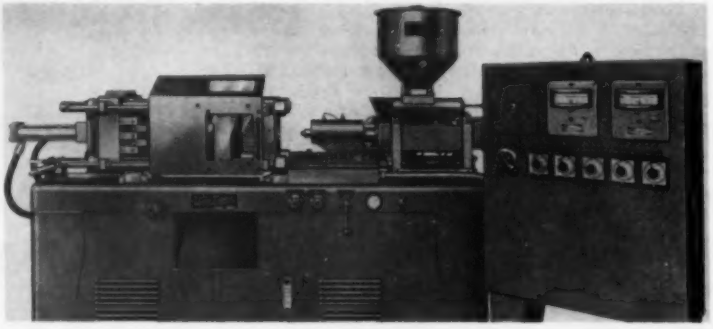
NEW MACHINERY-EQUIPMENT

Specifications and claims are those of the manufacturers and/or their agents.

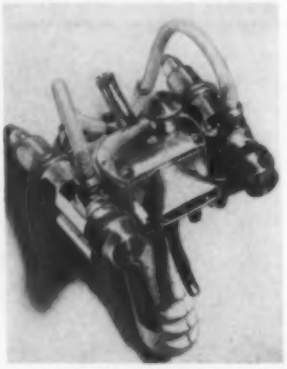
Four-tie-bar injection machine has 2½-oz. capacity

Designated Model H-270, this 4-tie-bar machine has a shot capacity (with pre-pack) of 2½ oz. of polystyrene and a plasticating capacity of 35 lb./hr. with the same material. Maximum injection pressure on the material is 20,500 p.s.i. using a 1¼-in.-diam. plunger on an 8-in. stroke. Maximum dry cycle rate is 1000 cycles per hour. A double shear linkage clamping mechanism develops 55 tons of clamp force. The platen stroke is 7¼ in., and molds up to 10 in. wide by 16 in. high by 10 in. thick can be used. The injection system is hydraulically positioned for fast and convenient purging. The remote-control cabinet, pre-wired for easy installation in the molding plant, has been designed with modern components such as plug-in relays, timers, and pre-pack counter. Heaters are rated at 4.4 kw. and the press is powered with a 10-hp. motor (220-v., 3-phase, 60-cycle supply). Cylinder has two-zone, pyrometer-controlled heat input. Machine may be run manually, automatically, or semi-automatically. Optional equipment includes low-pressure closing, stop arrangement for intermediate platen positioning, weighfeeder, extended nylon nozzle (1½- or ¾-in. radius) with heater band and control, and 1⅛-in.-diam. plunger and sleeve for 25,300 p.s.i. injection pressure and reduced shot capacity. Basic machine is priced at $8,950. *The Van Dorn Iron Works Co., 2685 East 79th St., Cleveland 4, Ohio.*



Spray-up gun has three spray nozzles

The Polyspray M-4A spray gun consists of three spray nozzles. Two nozzles are used to meter and spray each of the two liquid resin components while the center nozzle is designed to spray simultaneously metered amounts of chopped fibrous glass into the area where the two liquid component streams converge on the mold surface. Interchangeable nozzles of various designs for the glass and liquid components make it possible to use the gun as either 1) a straight liquid spray gun, 2) a glass chopper and gun for spraying up preforms (special liquid nozzles are used simultaneously to apply binder), and 3) a resin-glass combination spray gun. The gun has an integral air motor and glass chopper to cut the glass roving into the proper spray-up lengths. The amount of glass sprayed may be set between 0.11 and 3.75 lb./min. and the amount of resin sprayed between 0.45 and 11 lb./min.; streams are separately adjustable so that most any ratio of resin to glass may be set up and maintained. A big advantage of the gun is its light weight, 3¾ lb., which allows it to be controlled with one hand, leaving the operator's other hand to roll out the material which has already been deposited. *J. Coudenhove, Kunststoffe-Maschinen, Strauchgasse 3, Vienna, Austria.*



Foam splitter

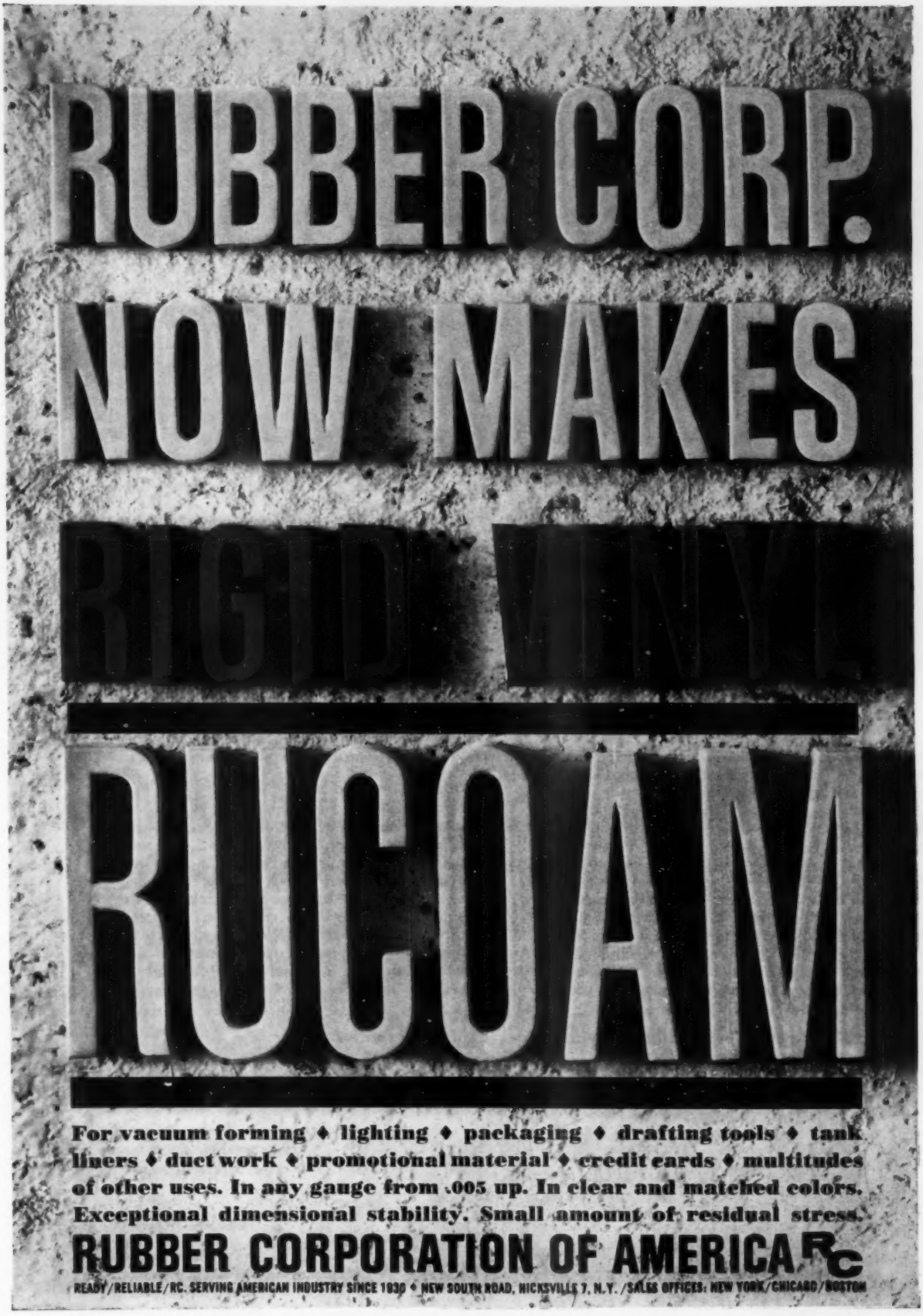
Called the Universal Splitting Head, this machine can be used to split and level blocks of plastic foam up to 42 in. thick. The unit may be used singly or in series along existing conveyor systems. It will split either rigid or flexible foams. Clearance over the knife bar on the splitting head is 12½ inches. The machine is available in standard widths of 50, 60, 72, or 80 in.; other widths on request. The cutting knife is adjustable from ¼ to 42 in. above the conveyor surface and is raised or lowered by a hand crank or an optional automatic indexing mechanism. Among other optional equipment available are: a motorized blade sharpener, take-away and wind-up conveyor, and horizontally and vertically adjustable compression roll assembly. *FEMCO, 1734 Front St., Cuyahoga Falls, Ohio.*

Sign-making equipment

This technique for the production of painted plastic signs was developed by the manufacturer of the equipment and requires the following items (all available from the manufacturer): 1) a special hand-operated embossing press with special type; 2) the desired plastic sheet (methyl methacrylate, butyrate, etc.) with a special strippable coating; and 3) paints which are compatible with the sheet used. The press is used to cut the outlines of the lettering in the strippable coating. The strippable coating covering those areas to be painted a different color than the basic sheet color is then removed. The remaining coating then acts as a spray mask. The sheet is then sprayed with the paint and dried. After the paint has dried, the remaining coating is removed producing the colored lettering which contrasts with the base color of the sheet. *Embosograf Corp. of America, 38-44 West 21st St., New York 10, N. Y.*

Fluidized-bed coating tanks

For larger-sized parts, two production models of the Vibro Fluidizer, Model D, and a larger model, Model E, are designed for coating applications using powdered resins and the fluidized-bed-coating technique. Inside diameters of the dip tanks are 18 and 22 in., inside depths are 23 and 30 in., and the operating capacities of the two units are 25 and 48 gal., respectively. Units are air-powered; air being used for both the vibrators and to fluidize the powdered resin bed. All units are supplied with controls for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Specifications and claims are those of the manufacturers and/or their agents.

both vibrator and bed air and are equipped with air filters to prevent contamination. It is recommended that dry air be used; dryers for the units are available on request. Price of the Model D is $575.; Model E, $675., both F.O.B. mfr. Quotations on other sizes and custom units on request. *Armstrong Resins Inc., Warsaw, Ind.*

Hot-melt spray unit

This unit is designed to spray a strippable thermoplastic protective coating on parts too large to be encapsulated by the dip method for shipment or storage. The compact unit consists of a specially designed spray gun with a temperature-adjustable (150° to 400° F.) heating jacket, an insulated, temperature-adjustable supply hose, and a portable, ½-hp., self-purging, pumping unit which mounts on a controlled-temperature melt tank. The plastic material used has an approximate melting point of 350° F., which temperature is maintained from supply tank to target. A ⅛-in. coating may be laid down at rates up to about 8 to 10 sq. ft./min. Unit requires a 115-v., 3-wire power source and a 60- to 80-p.s.i. air supply. *Evens - Thompson Mfg. Co. Inc., Toledo, Ohio.*

Anti-static cleaner

The Simco plastic parts cleaner combines a brush, a shockless static bar, and a suction hood. The part is first mechanically brushed to remove dust and dirt, then electrically neutralized to prevent reattraction of the dust, while the suction hood removes the dust dislodged from the work area. The cleaning bar can be supplied in various lengths to suit the application, and it is available for use with either 110- or 220-v. power. Suction blower is not included but may be purchased from the manufacturer. *The Simco Co., 920 Walnut St., Lansdale, Pa.*

Urethane foam molding machine

This machine is a complete, self-contained urethane foam mold-filling line. In operation, molds are placed on a conveyor in the machine and are advanced to and indexed at the mold-filling station, where they are filled with the mixed components of the urethane foam. Total cycle is 9 sec.; 3 sec. to move the next mold into filling position, and 6 sec. to fill the mold. The unit will deliver up to 5 lb./min. of foam, using a stainless steel recirculating-type mixer with air-operated valves. During mold changes, resin flow is said to be completely shut off and no dripping occurs. Metering accuracy is claimed to be better than 1 percent. After the unit is loaded with resin components, only two connections are required to place the machine in operation: a 3-phase 220-v. line and an 80-p.s.i. air line. Controls are mounted on a single panel. *The Sterling Alderfer Co., 3850 Granger Rd., Akron 13, Ohio.*

Pressure former

For short runs and development work on pressure-formed items up to 10 by 10½ by 4 in. deep, the Thermtrol Model 100 machine may be used with oriented styrene as well as other thermoplastic materials. In addition to forming the item, the press trims the part on the same cycle. Although the press must be closed manually, the balance of the cycle is automatic. Timers control the heating, forming, cooling, and cutting operations in proper sequence after which the press opens automatically. Typical total cycle for a 9-in.-diam. pie cover made from 7.5-mil oriented polystyrene sheet is 2 seconds. *Thermtrol Corp., 63 Station St., Southport, Conn.*

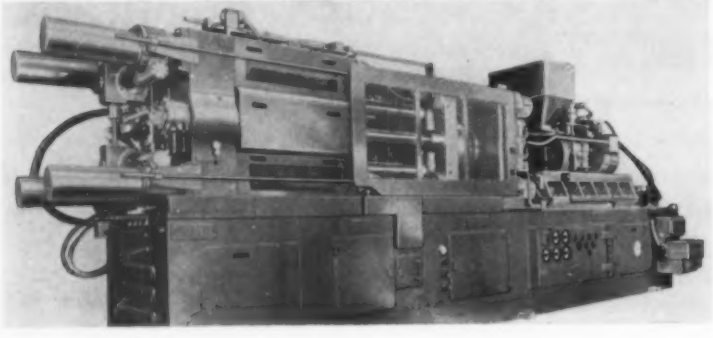
Drying oven

For the drying of thermoplastic materials, this vacuum oven is designed for rapid and positive moisture removal to laboratory levels of dryness in production quantities. Use of vacuum eliminates the need for desiccants and dehumidifiers. Dried material can be stored under vacuum in special containers until ready for use. IMS vacuum ovens are designed for flush mounting, with all controls and motors installed out of the way on top of the unit, where they are accessible for easy maintenance. Units are priced at $2250 complete and are available out of stock for 220-v. connections. *Injection Molders Supply Co. Inc., 17601 S. Miles Rd., Cleveland 28, Ohio.*

Small compression press

This 20-ton HYSCO compression press, with an 8 by 8-in. platen area, maximum daylight of 12 in., and a stroke of 6 in., is suitable for process development, short-run and small parts production, or investigative laboratory work. It is available with either a hand-operated pressure pump or powered by a 110/220-v., 1-hp. electric motor. The press is single-acting up-stroke with gravity return. Platens are electrically heated with individual thermostatic controls and may be cored for water cooling. Other sizes are also available on request. *Hydraulic Supply Co. Inc., 10801 S. Sessler St., South Gate, Calif.*

Reciprocating-screw injection machine with 71-oz. rated shot capacity



Designated Model AP30/115, this reciprocating-screw machine has a shot capacity of 115 cu. in., or about 71 oz., of polystyrene. Plasticating capacity ranges between 250 and 300 lb./hr.; maximum injection pressure on the material is 10,000 p.s.i. Heater power consumption is rated at 11 kw. and the machine is equipped with a 50-hp. motor. Projected molding area is rated at 350 sq. in., but will depend on the mold and the material. Clamping force is 600 tons and molds up to 25¾ by 43 in., between 12 and

Assembling automatic transmissions at Ford's modern Fairfax-Sharonville Plant, Sharonville, Ohio. Special plastic trays containing valve bodies are stacked in the foreground. Insert shows close-up of tray economically thermoformed from MARLEX sheet and marketed by The Baxter Company, Cincinnati, Ohio.

Trays made of MARLEX* increase handling efficiency on Ford assembly line

For more efficient handling of automatic transmission valve bodies at Ford's Fairfax-Sharonville Plant, they have recently adopted specially designed trays of MARLEX high density plastic. These trays play an important role in maintaining quality on finished transmissions since the critical parts involved must be thoroughly cleaned and carefully protected from unnecessary abuse . . . scratches, nicks, etc. More specifically, the specially designed MARLEX trays are an efficient carrier during degreasing . . . and a safe one during assembly. They are lightweight, tough and durable. And, because these trays are thermoformed (no expensive molds required), they are economical in the custom quantities required.

Increasingly, manufacturers are relying on special and multi-purpose tote boxes, trays, storage and assembly-line units made of MARLEX to increase material handling efficiency. When made of MARLEX, these units are virtually indestructible—tough, durable, lightweight . . . resistant to acids, alkalies, greases, rot, corrosion, and degreasers like trichloroethylene . . . non-absorbent and capable of withstanding temperature extremes from −180°F to 250°F (can be steam-cleaned).

For an ever-growing number of applications, MARLEX high density polyethylenes and ethylene copolymers provide superior performance and economy. They can do the same for you and your customers! For full details contact the nearest sales office listed below.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma, a subsidiary of Phillips Petroleum Company

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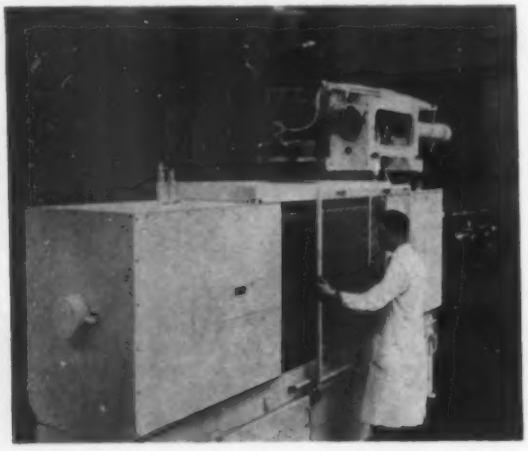
PHILLIPS 66 MARLEX PLASTICS

Specifications and claims are those of the manufacturers and/or their agents.

26 in. thick, can be handled. Clamp stroke is 32 inches. Mold height is hydraulically adjustable over a range of 14 in. by means of synchronized tie-bar nut drives. *R. H. Windsor Limited, Leatherhead Road, Chessington, Surrey, England.*

Blow molder

The Granbull Model 53 single-station blow-molding machine is equipped with an accumulator and is capable of handling moldings up to 34 in. high by 20 in. wide by 20 in. deep; it will produce round bottles up to 30-gal. size, square bottles up to 40-gal. size. Maximum weight of the molding possible is 15 lb. of polyethylene. Parison ejection pressure is 2800 p.s.i. and mold clamping force



is 25 tons (maximum). Platens ride on 4 tie bars and are 38 in. high by 26 in. wide; space between platens is 10 in. fully closed and 52 in. fully open. Average air consumption is 300 cu. ft./hr. and 4 g.p.m. of cooling water at 18 p.s.i. is required. Unit is designed to operate with a 3½-in. extruder with an approximate output of 200 lb./hr. of polyethylene. Cycle is semi-automatic. Controls are located in a separate cabinet to eliminate inaccuracies due to machine vibration. *Baker-Perkins Granbull Ltd., 39 High St., Kingston-upon-Thames, Surrey, England.*

Winding equipment

This line of low-cost "Reel-Wynders" and drives is designed to provide controlled tension for winding plastic film, filaments, and other center-wound materials. Units include a fluid drive which automatically delivers increasing torque and tapered tension over core ratios as high as 8:1 while process speeds may vary as much as 3:1. Units are easily adjusted to provide a wide range of tensions and speeds, permitting the application of a single unit to a large variety of winding jobs. Output ratings are from ⅛ through 3 hp., and five standard sizes provide winding speeds from 3.5 to 3500 r.p.m. Prices of the assembled unit, including a ball-bearing A.C. motor, less starter, begin at $250. *Fluid Drive Engineering Co., 313 Hibbard Rd., Wilmette, Ill.*

Mask washer

The Model W-1600 high-pressure-spray washing machine for the cleaning of masks used in decorating plastics is designed to be intermediate in size between two smaller and four larger units made by the manufacturer. It handles masks as large as 16 in. square and holds 5 gal. of strip solvent. It is said to clean three times as fast as agitation-type washers requiring 15 gal. of solvent. Completely enclosed, the system eliminates fire hazards associated with open tanks and the spray cleaning reduces damage which might occur due to mask handling. It is claimed the unit will remove up to 20 wet coats of paint in 20 seconds. *Conforming Matrix Corp., 787 New York Ave., Toledo 11, Ohio.*

Catalyst injector

For gel-coat and laminating work, the catalyst injector is a specially designed pressure pot to hold catalyst. Atomizing air, on its way to the spray gun, is passed through the control block on the unit. Whenever the air flows, catalyst flows into the air stream through an indicating flow meter. The catalyst enters the spray gun with the atomizing air through a special hose which is provided. When spray stops, catalyst flow stops instantly. Accidental reverse flow is prevented by a check valve. Any predetermined rate of catalyst flow may be set by means of adjustments on the meter. Use of the catalyst injector prevents accidental plug-ups and waste of resin when process interruptions occur by keeping stored resin uncatalyzed until used. Price F.O.B. mfr.: $250. *Finn and Fram Inc., 8402 San Fernando Rd., Sun Valley, Calif.*

. . . Machinery in brief

▶ An entirely new line of fractional hp., right-angle gear motors from ⅛ to ½ hp. Major change is weight of motor; ¼-hp. motor weight has been reduced by almost 50%, to 26 pounds. *Reliance Electric and Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.*

▶ Small Thermo Electronic self-balancing indicators can be used with multiple sensing elements by using multiple point switches. Compact, the indicators require only 56 in. of panel space. *Thermo Electric Co. Inc., Saddle Brook, N. J.*

▶ The Model CG-21 Universal cutter-grinder for sharpening single-lip engraving and routing cutters for plastics is now available from *H. P. Preis Engraving Machine Co., 250 U. S. Hwy. 22, Hillside, N. J.*

▶ A movable strip chart recorder converts standard testing machines having an adapter unit to permit the collection of specialized test data. *Tinius Olsen Testing Machine Co., Easton Rd., Willow Grove, Pa.*

▶ Two new instrumentation units. The Model 212T Transcope Differential Pressure Transmitter for flow instrumentation and the Model 100N Precisor Valve Positioner for diaphragm-type control valves. *Taylor Instrument Cos., 95 Ames St., Rochester 1, N. Y.*

▶ Simple, low-cost vacuum conveying systems for unloading bulk shipments and intra-plant transfers are designed to handle up to 8000 lb./hr., depending on the distance the material is to be transported. *Whitlock Associates Inc., 21655 Coolidge Hwy., Oak Park 37, Mich.*

▶ A complete line of totally enclosed, fan-cooled motors has been added to GE's family of Form G fractional horsepower motors. *General Electric Co., Schenectady, N. Y.*

▶ A portable pneumatic unloader for use with Airslide cars handling powdered resins and similar materials. The unit has hydraulic positioning controls to simplify and speed up unloading preparations. *Sprout, Waldron & Co. Inc., 130 Logan St., Muncy, Pa.*—**End**

Automatic . . . Semi-Automatic . . . Manual

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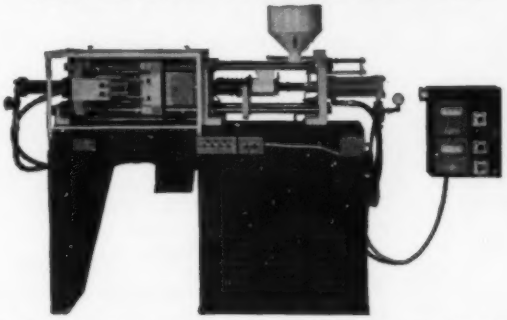

Fully automatic. Up to 2 oz. capacity. Hydraulic. Approximately 42 tons clamping pressure. 8" x 11" mold area. Up to 10 cycles per minute. Interchangeable cylinders. Horizontal clamping 2-zone heating cylinder. Pre-pack stroke—$6,470.

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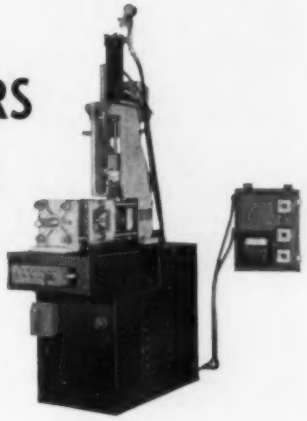

Fully automatic, Semi-automatic, Manual. Horizontal clamping. Capacity to 1 oz. Air or hydraulic. From $1,785 to $3,600.

ELDORADO MINI-JECTORS

Automatic, Semi-automatic and Manual. Up to 1½ oz. capacity. Mold area 6" x 5⅛" x 5". Hydraulic power. Ideal for molding involving inserts or loose cores. $5,400 to $3,385.

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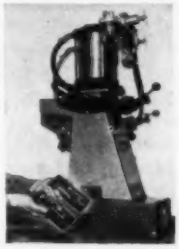

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WORLD-WIDE PLASTICS DIGEST*

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

What's wrong with data on reinforced plastics? H. Raech. Materials in Design Eng. *53*, 121-5 (May 1961). A critical review of standard mechanical tests on reinforced plastics is given.

Standards for plastic pipe and fittings. F. W. Reinhart. SPE J. *17*, 159-60 (Feb. 1961). The current status of standards for plastics pipe and fittings are summarized. The major areas in which work is underway are discussed.

Ethylene readies for a new role. Chem. Week *88*, 51-2, 54 (June 10, 1961). Copolymers of ethylene with butene-1, propylene, vinyl acetate, and ethyl acrylate are described.

Insulation Directory. Insulation Encyclopedia Issue 7, 210-243 (May 1961). Information is presented on nonsupported flexible plastic and elastomer films, tapes, and sheeting (not self-adhering), and on reinforced and laminated plastic sheets, tubes, and rods, copper clad and unclad, plain and composite.

Materials

Compounding of dissolved polymethyl methacrylate with fillers. I. A. Uskov, Iu. G. Tarasenko, and T. A. Kusnitsyna. Vysokomolekuliarnye Soedineniia *3*, 37-40 (Jan. 1961). Employing organic bentonite derivatives and polymethyl methacrylate as examples, a method is described for incorporating a filler into a polymer in the dissolved state with subsequent coprecipitation of both components. According to data of differential thermographic analysis this leads to dense screening of the filler surface by macromolecules of the polymer, *i.e.*, to compatibility of the components. The strength of the resultant filled polymer in the glassy state is higher and the flow temperature considerably higher than it is for the pure polymer.

Polyvinyl titanic esters and related compounds. E. S. Lane. J. Applied Chem. *11*, 1-4 (Jan. 1961). Methods are described for preparing polymerized vinyl esters of titanic acid. Although polyvinyl titanate is representative of organic esters exhibiting high stability towards hydrolysis, the preparation of ion-exchange resins from these materials is not practical. The separation of heavy metal ions by these resins is satisfactory using neutral or alkaline media, although the process is extremely slow. In addition, the use of acidic media caused serious losses of titanium.

New methods of modifying the properties of cellulose. Z. A. Rogovin. J. Polymer Sci. *48*, 443-56 (Dec. 1960). New derivatives of cellulose are reported and discussed.

High polymers and their intermediates in the phosphonitrilic halide system. R. A. Shaw. J. Polymer Sci. *50*, 21-30 (Mar. 1961). Polymers in the phosphonitrilic halide system are classified into addition and condensation polymers. Recent results bearing on the structure and mechanism of formation of "inorganic rubber" are discussed. Views on the structure of condensation polymers of a ceramic type are put forward, and the first phosphams with different, but reproducible, physical properties are reported. The stereochemistry of one of the most important intermediates, the cyclic trimer, is discussed and explained in full detail.

Molding and fabricating

Blow molding of PVC compounds. G. H. Burke. Brit. Plastics *34*, 118-22 (Mar. 1961). Techniques for blow molding polyvinyl chloride (PVC) are outlined, and the most suitable equipment for the process is described. Most types of normal and high-impact unplasticized PVC have been used successfully, with no apparent trouble due to stabilizer systems. Nearly all types of plasticized PVC compounds may be used successfully. However, some difficulty was observed when using polyester-type plasticizers, or extenders such as chlorinated paraffins. Of particular interest is the ability to blow mold scrap compound from the rotational casting process.

Performance of single-screw extruders in the processing of polyolefins and PVC. O. Schiedrum and H. Dominghaus. Plastics *26*, 83-6 (Feb.); 81-5 (Mar. 1961). Some of the methods for improving and increasing the output of extrusion equipment are discussed. Methods of comparing actual measurement data on extruder output and the theoretical calculations are described.

Applications

Reinforced Teflon for dry bearing surfaces. R. C. Berry. Product Eng. *32*, 76-77 (Mar. 20, 1961). Oriented glass fibers improve the strength of Teflon. Addition of about 10% molybdenum disulfide as a second additive brings the lubricating properties of the reinforced Teflon to the same level as those of the virgin resin.

Epoxy pellets speed production of electronic components. V. Sussman. Materials in Design Eng. *53*, 12-13 (May 1961). A novel mass-production technique for encapsulating, impregnating, sealing, and bonding electronic components using epoxy pellets is described.

Polyethylene film for mulching. H. R. Spice. Plastics *26*, 56-57 (Mar. 1961). The use of polyethylene film as a mulch is becoming increasingly important in certain types of commercial farming operations. Various effects are obtained, depending on the opacity of the films. The effects as well as current work in the use of films with highly reflective coatings are discussed.

Resin-bonded particle board turns wood waste to profit. J. E. Hyler. Adhesives Age *4*, 30-33 (June 1961). The manufacture of particle board made from wood chips is described in these pages.

Testing

Creep testing by centrifugal-force loading. R. E. Hook, A. M. Adair, and J. W. Spretnak. Materials Research & Standards *1*, 464-70 (June 1961). A centrifugal-force-loading creep testing machine was designed, constructed, and tested.

Publishers' addresses

Adhesives Age: Palmerton Publishing Co. Inc., 101 W. 31st St., New York 1, N. Y.
British Plastics: Iliffe & Sons Ltd., Dorset House, Stamford St., London S. E. 1, England.
Chemical Week: McGraw-Hill Publishing Co. Inc., 330 W. 42nd St., New York 36, N. Y.
Insulation Directory (Insulation Encyclopedia Issue): Lake Publishing Corp., 311 E. Park Ave., Libertyville, Ill.
J. Applied Chem.: Society of the Chemical Industry, 14 Belgrave Sq., London S. W. 1, England.
J. Polymer Sci.: Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y.
Materials in Design Eng.: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.
Materials Research and Standards: American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.
Plastics: Temple Press Ltd., Bowling Green Lane, London E. C. 1, England.
Product Eng.: McGraw-Hill Publishing Co. Inc., 330 W. 42nd St., New York 1, N. Y.
SPE Journal: Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.
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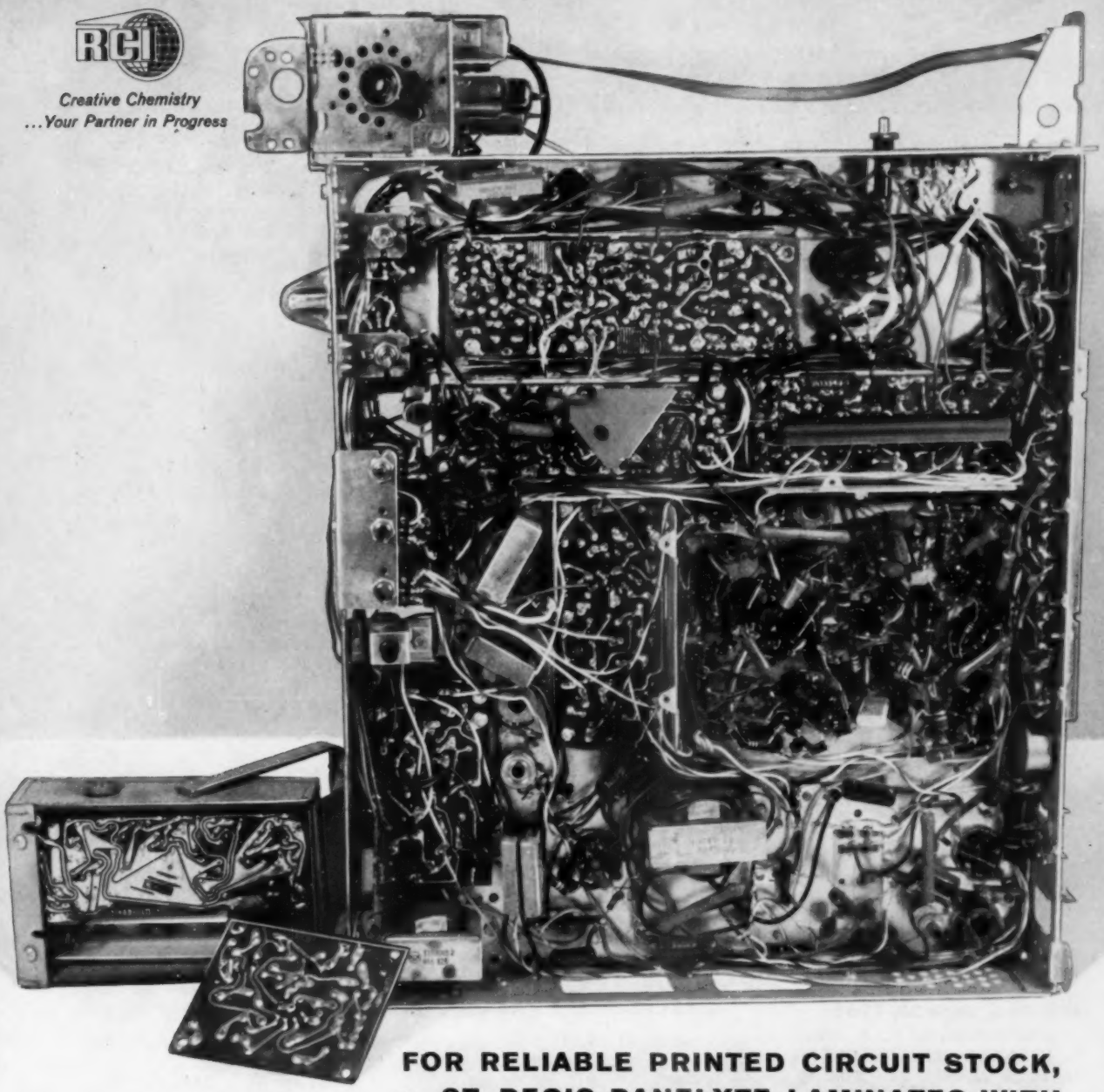

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U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

U. S. Pats., June 13, 1961

Polysaccharide composition. S. Rosenberg and D. Bandel (to American Machine & Foundry). 2,988,455.

Acrylic-glycidyl methacrylate copolymers. R. M. Fitch (to Du Pont). 2,988,524.

Foundry mold composition. A. G. Clem (to American Colloid). 2,988,525.

Anti-vesicant composition. W. W. Prichard (to Du Pont). 2,988,526.

Copolymer. G. Nischk, H. Holtschmidt, and K. H. Eisenman (to Bayer and Mobay). 2,988,532.

Curing epoxide resins. R. B. Feuchtbaum and D. L. Hinson (to Freed Transformer). 2,988,535.

Phenolic resins. J. M. Hine and J. F. Miller (to Borden). 2,988,536.

Fluoroolefin composition. D. W. Wiley (to Du Pont). 2,988,537.

Polyureas. W. Thoma, O. Bayer, and M. Rinke (to Bayer). 2,988,538.

Cross-linked polymers. L. Cohen, D. C. Spaulding, and J. F. Jones (to Goodrich). 2,988,539.

Anhydride polymers. W. L. Semon and J. F. Jones (to Goodrich). 2,988,541.

Fluorine-containing polymers. M. I. Bro, R. J. Convery, and R. S. Schreyer (to Du Pont). 2,988,542.

U. S. Pats., June 20, 1961

Isotactic polystyrene. W. A. Miller, C. N. Merriam Jr., and S. O. Cook (to Union Carbide). 2,988,783.

Irradiated polyethylene. R. J. Prochaska (to General Electric). 2,989,451.

Irradiated polymers. G. F. D'Alelio (to Bar Dal). 2,989,452.

Photopolymerization. W. Neugebauer, M. Glos, and K. Kasper (to Azoplate). 2,989,455.

Aromatic polyamides. W. A. Hare and H. L. Whyte (to Du Pont). 2,989,495.

Vinyl chloride plastics. W. E. Palm and L. P. Witnauer (to U.S.). 2,989,496.

Polyvinyl halide resins. R. M. Lycette (to Continental Can). 2,989,497.

Epoxy resin. J. B. D. Mackenzie, W. Fisch, and A. Renner (to Ciba). 2,989,498.

Epoxy resin. A. Bavley, F. W. Michelotti, and A. E. Timreck (to Chas. Pfizer). 2,989,500.

Bisphenol polyoxalates. G. S. Stamatoff (to Du Pont). 2,989,501.

Epoxy resins. W. E. Prescott and W. L. Bassler (to Dow). 2,989,502.

Powdered polycarbonates. B. P. Jibben (to Onderzoekingsinstituut Research). 2,989,503.

Polyurethanes. G. Nischk and H. Holtschmidt (to Bayer and Mobay). 2,989,512.

Sulfur-containing polymers. R. V. Jones (to Phillips). 2,989,514.

Polysiloxanes. J. G. Marsden (to Union Carbide). 2,989,559.

U. S. Pats., June 27, 1961

Electrostatic printing. J. A. Crumley, R. W. James, and J. Shulman (to R.C.A.). 2,990,279.

Photosensitive resins. J. O. Printy and E. W. Wagner (to Monsanto). 2,990,281.

Epoxy composition. G. Glaser (to General Mills). 2,990,383.

Alkyd-vinyl copolymer. A. F. Schmutzler (to France, Campbell & Darling). 2,990,384-5.

Styrene resins. E. G. Bobalek and E. L. Brazet (to American Marietta). 2,990,387.

Allylic resins. C. W. Johnston and D. Warren (to FMC Corp.). 2,990,388.

Vinylidene chloride-acrylonitrile copolymer. W. G. Grantham (to American Viscose). 2,990,391

Resinous composition. R. Saxon and M. T. Burgess (to American Cyanamid). 2,990,392.

Graft copolymers. H. W. Coover Jr. and J. B. Dickey (to Eastman Kodak). 2,990,393.

Stabilizers. W. F. Ainsworth, R. B. Wright, and B. Press (to Imperial Chemical). 2,990,394.

Polyethers. F. G. Jeffers (to Imperial Chemical). 2,990,395.

Polyoxyalkylene polyols. J. W. Clark and A. E. Winslow (to Union Carbide). 2,990,396.

Hydroxyethylation of polyvinyl alcohol. H. K. Inskip and W. Klabunde (to Du Pont). 2,990,398.

U. S. Pats., July 4, 1961

Vacuum thermoforming. A. G. Rowe, Jr. (to Du Pont) 2,990,581.

Shell molding. J. R. Lewis (to Hercules). 2,990,594.

Rocket. W. Cohen (to U. S.). 2,990,684.

Moisture-resistant building units. R. E. Parker. 2,991,190.

Laminated windshield. P. A. Miller (to Sierracin). 2,991,207.

Reinforced plastic vessel. G. Matkovich (to A. O. Smith). 2,991,210.

Polyethylene composition. C. F. Clark and R. W. Hill (to Spencer Chemical). 2,991,263 and 2,991,265.

Crystalline alpha-olefin polymer. G. C. Monroe Jr. and D. J. Vaughan (to Du Pont). 2,991,264.

Polysiloxane composition. B. A. Bluestein and J. C. Caprino (to General Electric). 2,991,266.

Curable polyethylene composition. M. J. Langan (to General Electric). 2,991,268.

Block copolymers. K. Nozakie (to Shell). 2,991,269.

Plastic-elastomer composition. A. N. Roper, E. S. Sal, and W. G. Barb (to Shell). 2,991,270.

Polycarbonates. W. Hechelhammer and G. Peilstocker (to Bayer). 2,991,273.

Alkyd resins. E. F. Carlston and G. B. Johnston. 2,991,274.

Hydrocarbon resins. M. Fefer (to Esso). 2,991,275.

Cross-linked nitrile polymers. L. F. *Arnold* (to Goodrich). 2,991,276.

Acrylic-trifluoroethyl vinyl ether copolymers. C. E. Schildknecht (to Air Reduction). 2,991,277-8.

Olefin polymers. F. F. Miller and D. S. Conner (to Goodrich-Gulf). 2,991,279.

U. S. Pats., July 11, 1961

Hydroxyalkylated polyamines. A. K. Ingberman (to Union Carbide). 2,992,192.-/**End**

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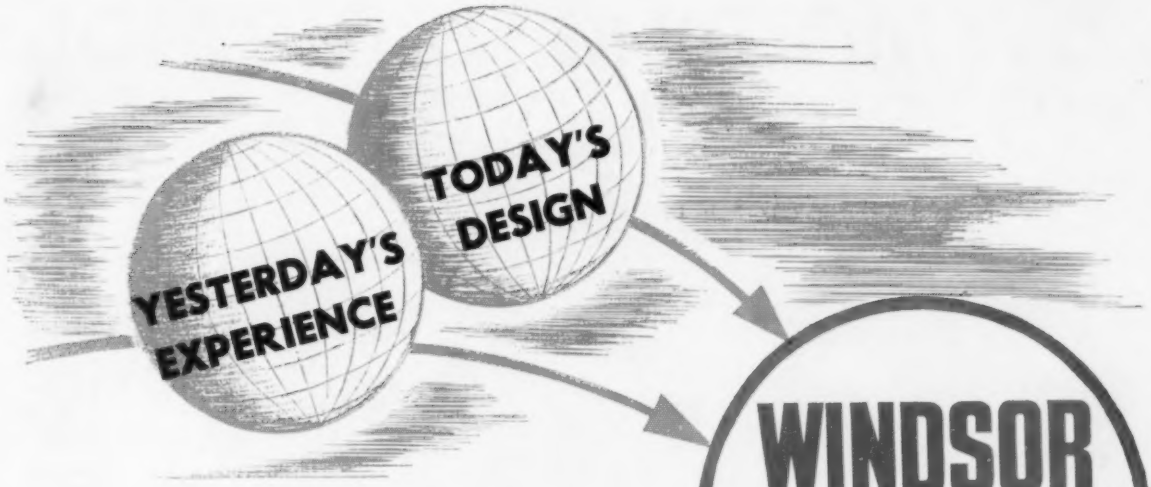

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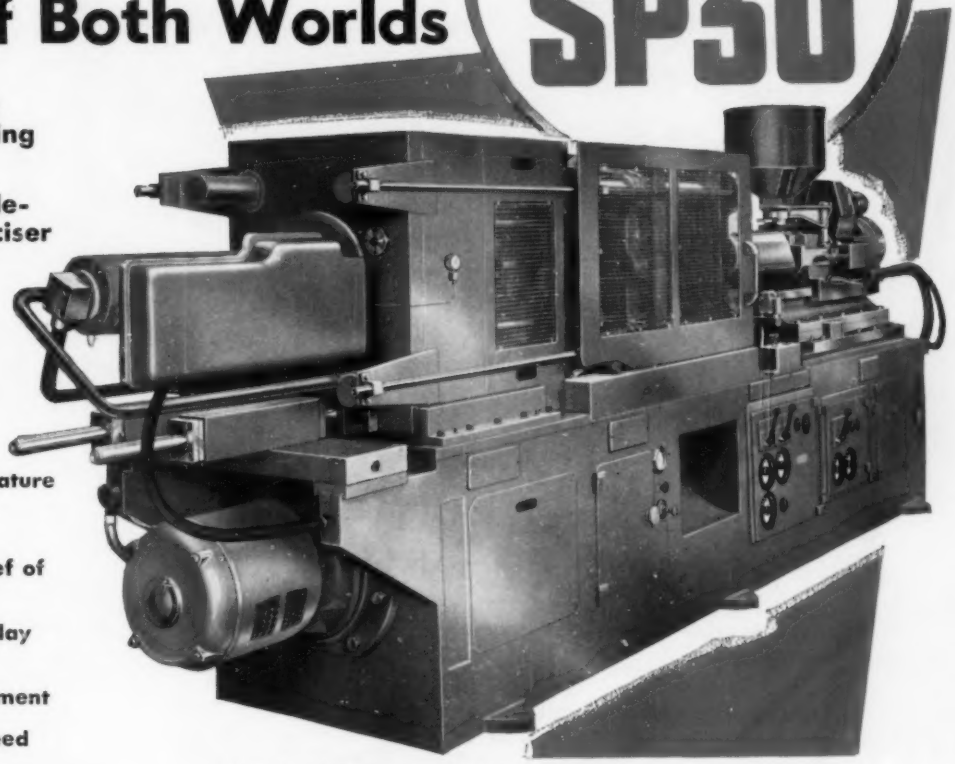

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Here's proof that NRM extruders are making startling gains in acceptance by the industry's blow molders. Machines in service in January, 1961, when the ad on the opposite page first appeared, were producing at a rate in excess of 72 million pounds of blow molded products per year. Today, that production capacity has jumped to 195 million pounds annually . . . a gain of 123 million pounds, or 174 per cent in just nine months!

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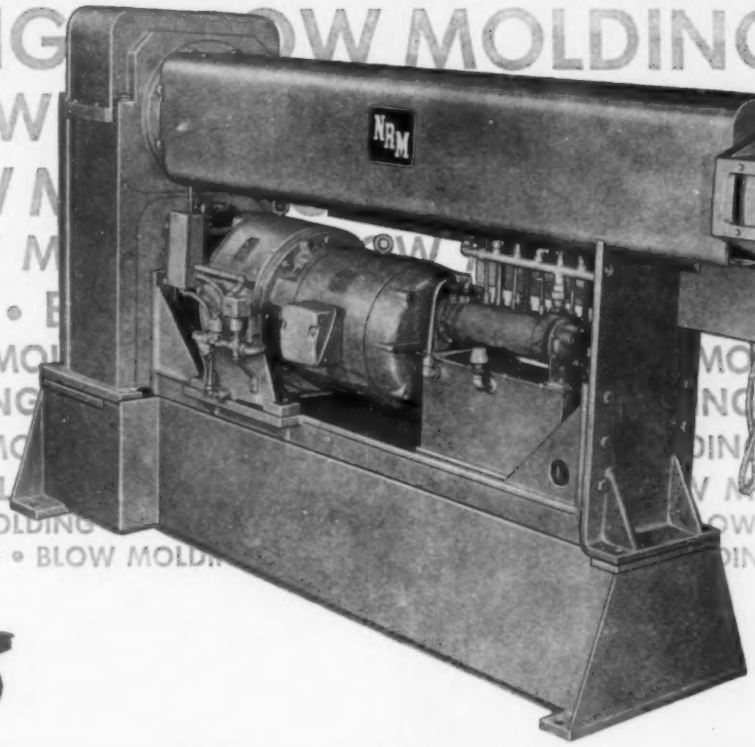

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Leading blow molders choose NRM Pacemaker extruders for use with all types of blow molding machines because they know that NRM's rugged, dependable design and construction assure them round-the-clock production, without costly downtime.

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U.S.I. POLYETHYLENE NEWS

A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

OCTOBER, 1961 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

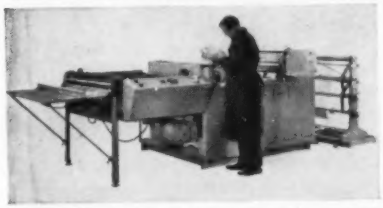
Packaging Notes

Polyethylene pour spout comes in sizes to fit quart and gallon paint cans. Snaps on and off in seconds and is reusable. Keeps paint out of lid groove. Puts an end to messy dripping. Available imprinted with advertising message.

Square-bottom and 3-D style polyethylene bags are being produced by a N. Y. converter from black and natural film in "any size . . . all gauges." A specialty is large, tailored shrouds and covers for domestic and military protective packaging. The largest to date: 450" x 96" x 168". Electronic seals are said to exceed strength of base material.

3-D style polyethylene bag can stand unsupported for easy filling.

Bottom-seal attachment is now available for side weld bag machines made by a leading company. With it, bottom-seal polyethylene bags 8" wide x 16" long can be produced at a rate of 200 per minute. According to the manufacturer, production speeds on large bags are also excellent, since bags up to 65" long may be made with a single stroke.



Tote barrel of molded polyethylene construction has sturdy wire handles and masonite reinforced bottom. It's dent-proof, water-proof and rust-proof, yet light in weight — an ideal multi-purpose container. Available in various sizes, including 25 and 45 gallons.

Polyethylene-Metal Construction Key to Lower-Priced, Higher-Quality Toys

Comparable All-Metal Items Take Longer to Make . . . Retail for More

In the highly competitive toy industry, a slightly lower retail price can be a critical factor—the difference between a good seller and a "shelf-sitter." And therein lies the primary reason why polyethylene is being incorporated in traditionally all-metal toys.

It lowers production costs, and—when used functionally — adds quality. The ultimate result: part-polyethylene, part-metal toys can be marketed at a price lower than all-metal items of similar quality.

Consider the experience of a company which produces nationally-marketed miniature cars, trucks, trailers, vans and boats.

The decision to combine the advantages of polyethylene and metal in a new line was made about a year ago. Since, sales and production figures have verified the success of the venture. According to the firm's purchasing agent:

"Combining polyethylene and metal has enabled us to market a higher quality product within the price range that encompasses our logical market. The polyethylene-metal toys retail for $1.00, which we feel is the right price for this type and size of toy. All-metal toys of this kind would have to retail at $1.19 or $1.29, making it necessary to fight sales resistance that doesn't exist at the $1.00 level."

Secondary Operations Eliminated

On the production line, the polyethylene-metal concept has worked out smoothly and efficiently. Manufacture culminates at the injection molding machines (each of which produces up to 200 polyethylene parts per minute depending on size and complexity), where molding machine attendants join the polyethylene parts with previously-cut metal parts made from zinc castings. Since there's little need to finish, scrape or trim the polyethylene components, secondary operations are virtually eliminated.

Assembly consists simply of securing the plastic part to its metal base by means of slots or undercuts. Wheels of injection-molded black polyethylene are then quickly affixed, and the toy is ready for packaging.

U.S.I.'s Role

U.S.I., as the polyethylene resin supplier, played an important part in the successful development of these toys. U.S.I. engineers were able to assist in establishing optimum equipment operating conditions, such as mold cycle times, and in making suggestions on materials.

The resin selected had to be absolutely uniform and have good strength, stiffness, gloss, colorant dispersion, and shrink and warp resistance. PETROTHENE 241 met these requirements and is being used for all parts but the wheels, which are made from PETROTHENE 597.

Moving van is typical of part-polyethylene, part-metal toys currently available. Wheels are made from U.S.I.'s PETROTHENE 597 resin, other plastic components from PETROTHENE 241. Chassis and cab are metal. Lower photo shows construction details.

His 'n Hers

New from France . . . a nubbly textured polyethylene rain hat designed to be worn by either a man or woman. It comes in a colorful, pocket-sized pouch. Can be turned into a cloche, or into one of a choice of men's styles, in seconds.

Available clear or in opaque colors, the hats are vacuum-formed from PETROTHENE 239-27 in Neuilly-sur-Seine. The U.S.I. resin was selected because it imparts stiffness and gloss, while providing optimum processing properties.

POLYETHYLENE HULL. First full-sized (9 ft. long, 4 ft. beam) hull of conventional polyethylene. One piece. Light (60-lb.). Tough (won't dent or rust; takes 5 hp outboard). Economical (retails lower than comparable reinforced plastic boats). Powder molded from U.S.I.'s MICROTHENE® polyethylene by Sintrex Division of Amos-Thompson Corp., Edinburg, Ind.

TWO BIG FIRSTS FOR MICROTHENE® POWDER MOLDING

POLYETHYLENE MEAT TANK. One-ton capacity. For transporting, storing, processing meats. Thick walled. Light. Easily cleaned. Resists juices and chemicals. Powder molded from U.S.I.'s MICROTHENE® polyethylene by Sintrex Division of Amos-Thompson Corp., Edinburg, Ind.

Sintrex Division's plastic boat and one-ton meat tank are two new large-size commercial products made from powdered polyethylene to be marketed in this country.

They're both produced by powder molding technology from MICROTHENE powdered polyethylene supplied by U.S.I. This new polyethylene molding technique has been used in Europe, but was little used in America until U.S.I.'s MICROTHENE was introduced two years ago.

Advantages of powder molding with MICROTHENE:

• **Large polyethylene parts are easy to produce.** Moldings made by Sintrex would be difficult or impossible to produce by conventional plastics fabrication methods such as injection molding or blow molding. Moldings are smooth, seam-free, strong.

• **Speed of production.** Sintrex produces plastic boat hulls many times faster than is generally possible by manufacturing methods for reinforced plastics.

• **Economy.** Process requires only simple, relatively inexpensive molds. Many products made by this method have a price advantage over those molded by other procedures.

Powdered Polyethylene for a Variety of Applications

Besides powder molding, versatile MICROTHENE powdered polyethylene may be used as protective or decorative coating on rigid substrates such as metal and glass. Other applications include rotational molding of hollow shapes and heat seal coatings for both woven and nonwoven fabrics. Write U.S.I. today for samples of MICROTHENE and for complete technical data.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
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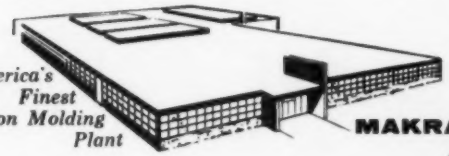
YOU CAN SECURE PRODUCTION SAVINGS WITH MAKRAY MOLDING TECHNIQUES WITH THE

MAKRAY *ok*

And that's not all: Skillful designing of molds and experienced engineering can help eliminate "bugs" and assure adherence to production time tables. America's finest injection molding plant with its complete facilities can provide you plastic products that look, work and sell better:

- 24-hour operation assures adherence to delivery schedules.
- 30 new hi-speed presses with 3 to 80 oz. capacities can handle almost any size job.
- Precision molds designed, engineered and built in our own shop.



America's Finest Injection Molding Plant

WE TAILOR OUR DELIVERIES TO MEET YOUR SCHEDULE

MAKRAY MANUFACTURING COMPANY
4400 North Harlem Ave., Chicago 31
GLadstone 6-7100

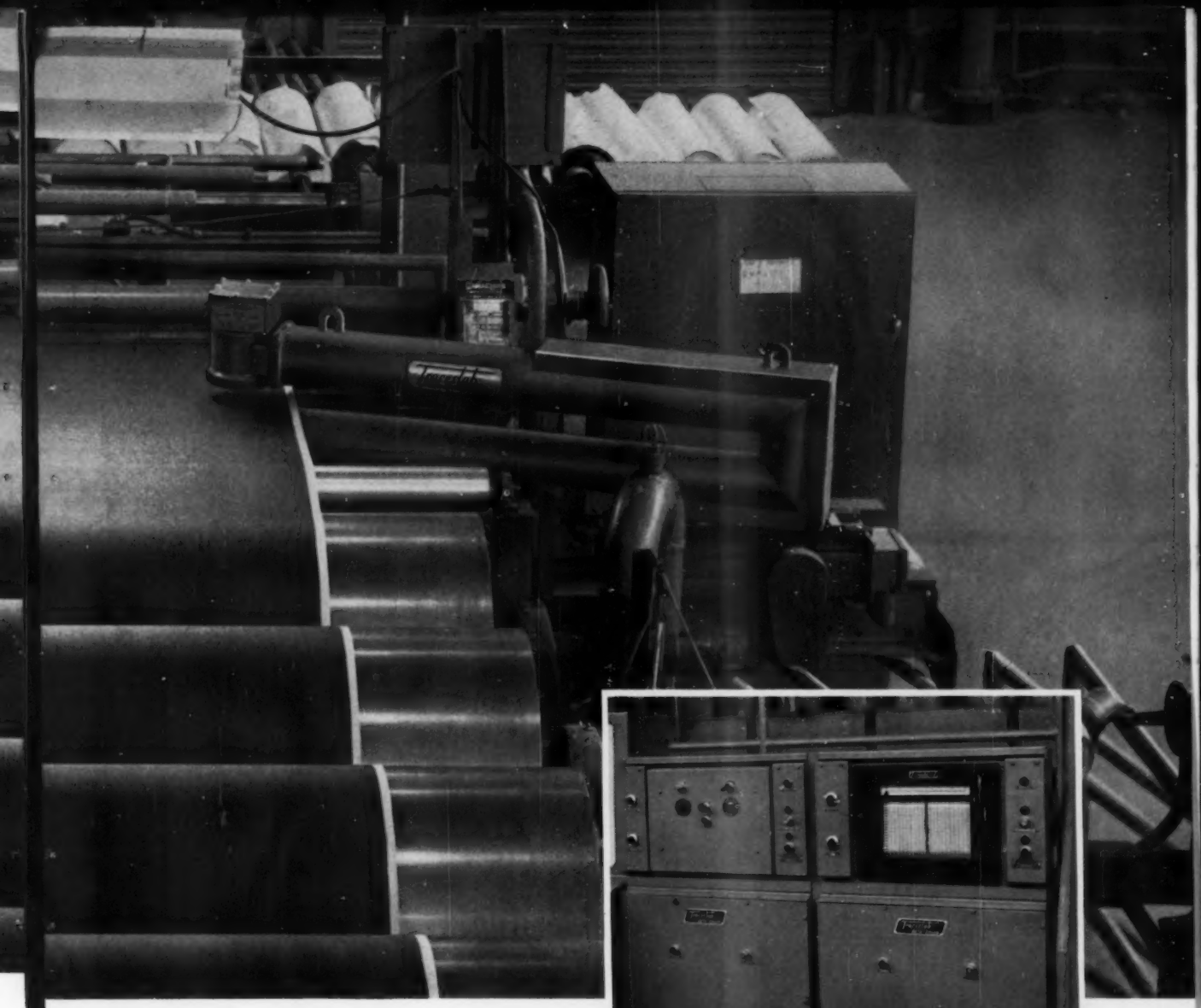
a new Tracerlab Automatic Process Control installation

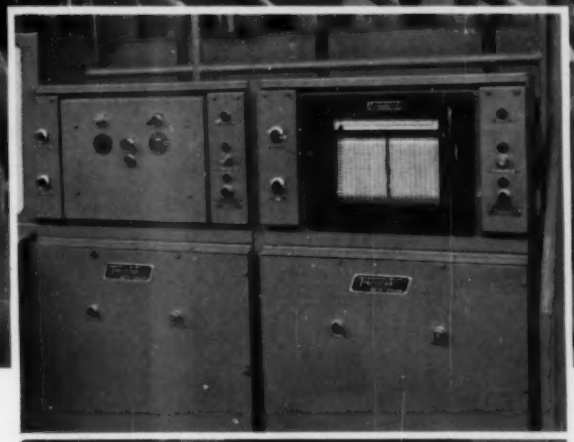
General Tire's Textileather Division makes its quality automotive upholstery better than ever with a new *Tracerlab Automatic Gauging System.*

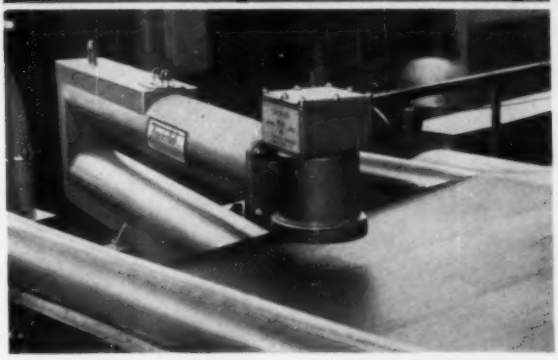
Tracerlab Beta Gauges are used to control the uniformity of thickness of Textileather to exacting tolerances. Control of uniformity insures Textileather's customers of consistently high quality upholstery material and helps General Tire's Textileather Division produce *a better product, faster, and at lowest cost.*

As the pioneer in the design and development of Beta Gauges (Tracerlab made the first commercial installation in 1948), Tracerlab can solve gauge control problems and *stay within your budget.* Lease and rental plans are available.

For further information get in touch with Tracerlab.







ABOVE:

Machine direction and profile basis weight control are obtained through use of two Tracerlab Automatic Beta Gauges. Canted C-Frames permit simultaneous edge measurement as well as profile scanning of the entire sheet.

TOP RIGHT:

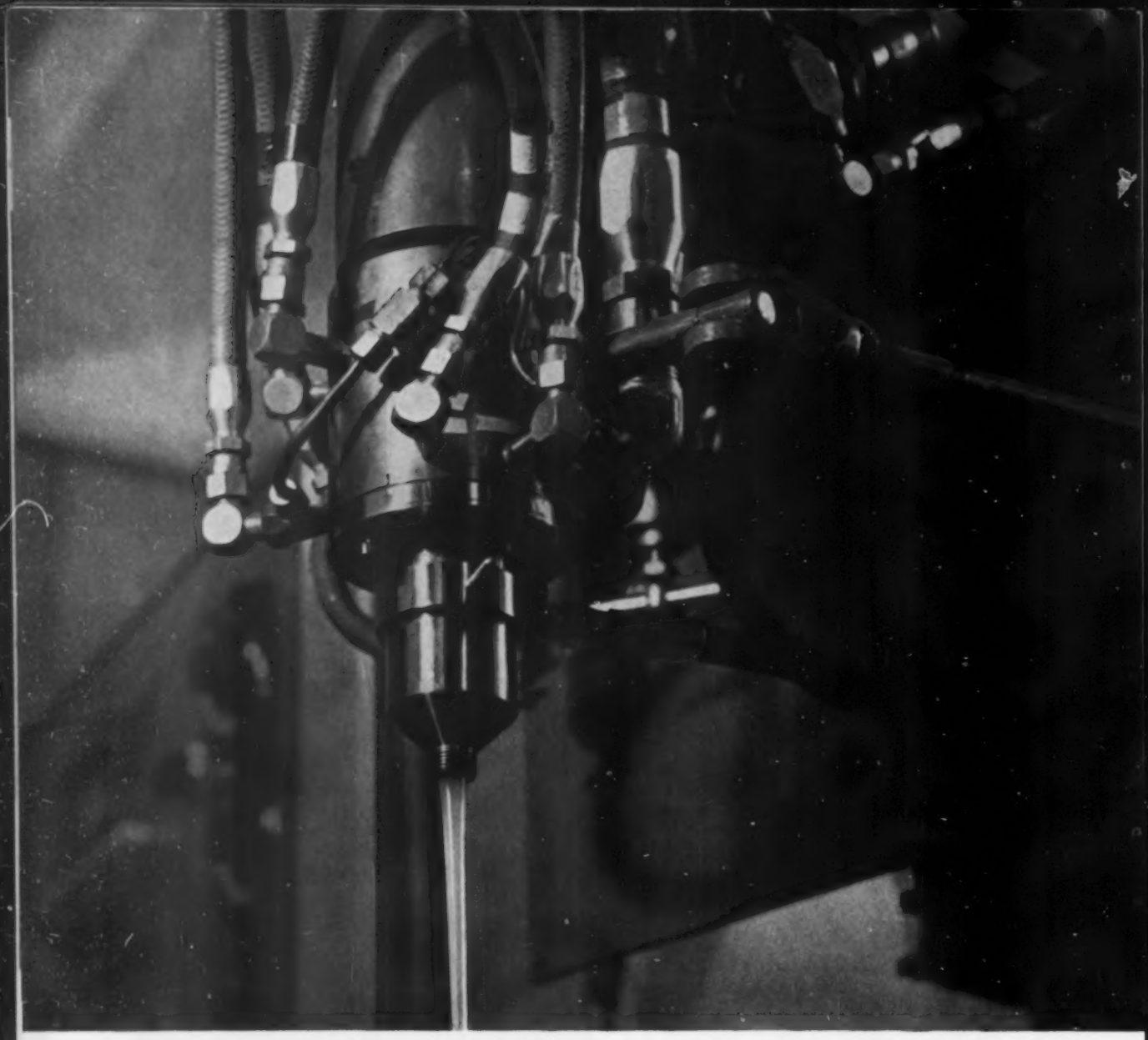
Signals from the two Beta Gauges give instantaneous indications of any basis weight variations and are clearly displayed in this continuously balanced strip chart recorder.

RIGHT:

Tracerlab's unique source-detector design results in the highest accuracy even for the thinnest materials.

Tracerlab **INDUSTRIAL DIVISION**

1601 Trapelo Road, Waltham 54, Massachusetts • ATTN: Mr. John Wood



T-9 is the superior catalyst for U-Foams

More one-shot foam is made with M&T Catalyst T-9 than with any other tin catalyst because it promises and *delivers* high uniform activity essential to proper balance of foaming and polymerization reactions. Catalyst T-9 is the preferred catalyst because its higher stannous content makes it even more economical than stannous octoate—and because it is more uniform, maintaining its activity to give you constant, reproducible U-Foam.

Your inquiries on "tin catalyst" problems are invited. M&T's technical service laboratories include a production-type foaming machine, an example of M&T's pioneering leadership in the development of foam catalysts.

M&T CHEMICALS

M&T PRODUCTS FOR PLASTICS

U-FOAM STANNOUS CATALYSTS
- M&T Catalyst T-9
- M&T Catalyst T-18
- M&T Stannous Octoate
- M&T Stannous Oleate

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VINYL STABILIZERS
- Thermolite® Organotin Stabilizers
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- Thermoguard®-Antimony-Based Flame retarders
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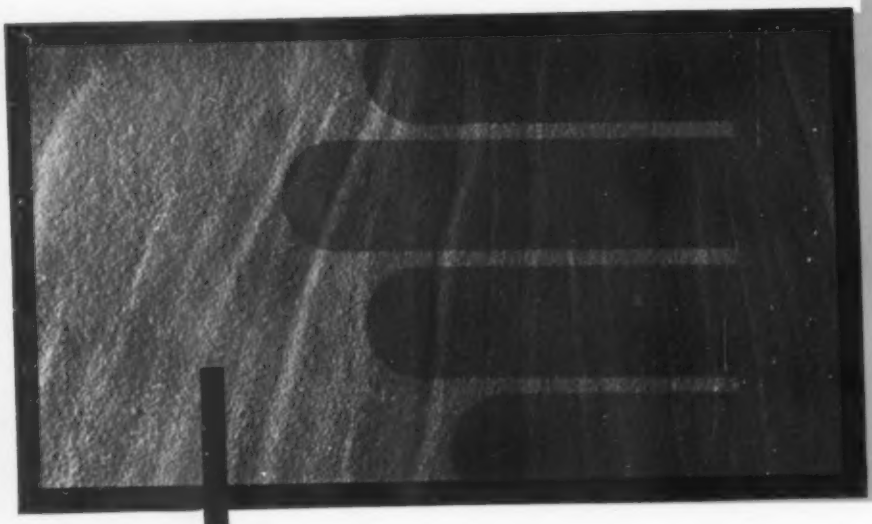
Anger

Well,
finally we've
got it

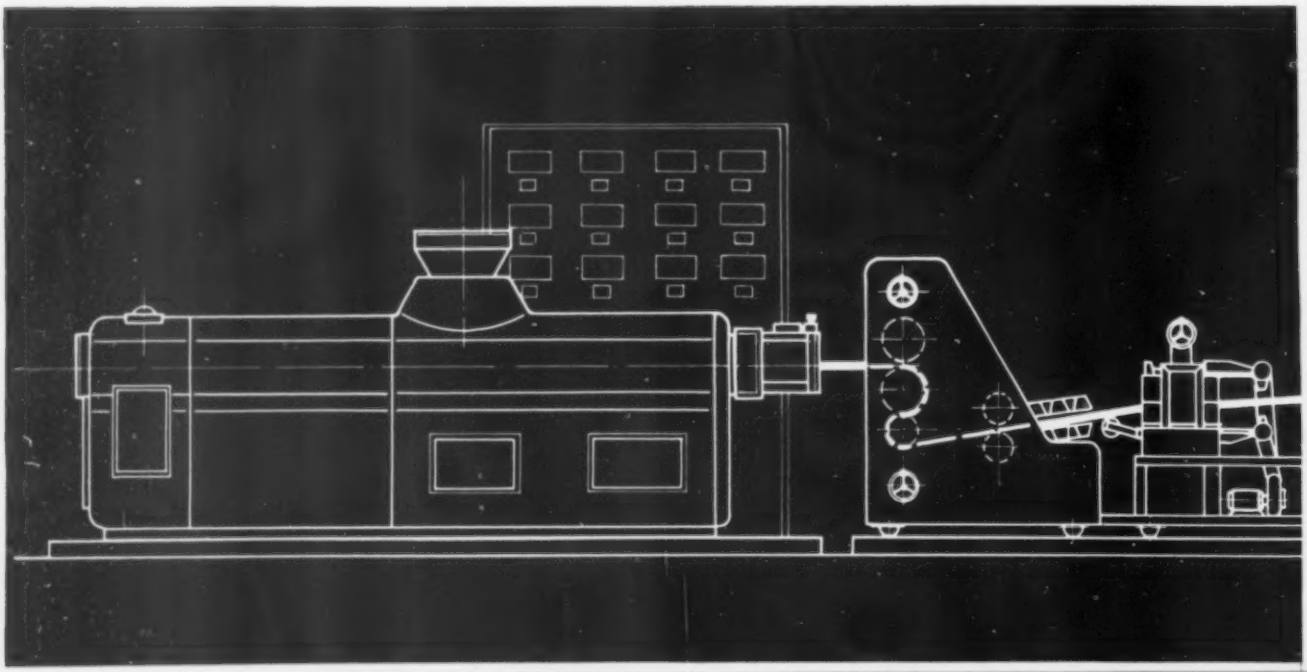
...THE DIRECT, low-cost

Start with
basic material:
PVC POWDER in a dry-blend mixture



from POWDER...

...all in one fully

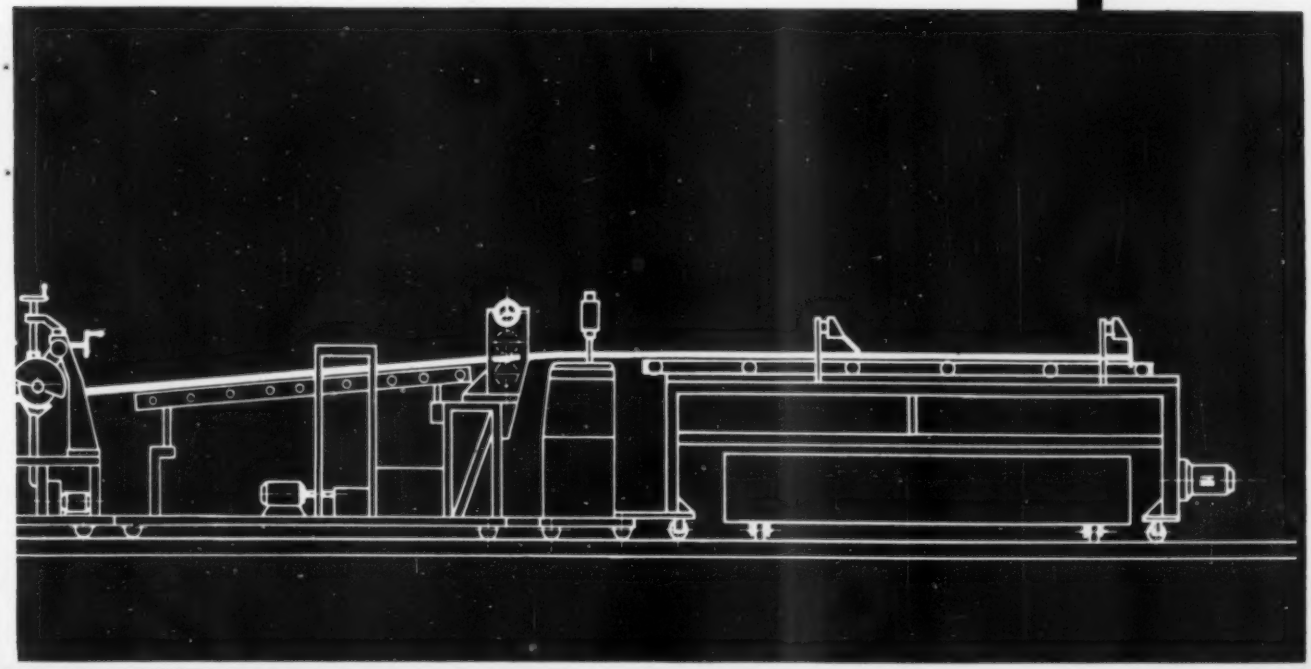


Anger route

Finished product:
transversely or longitudinally corrugated
. . . or smooth sheets of rigid PVC

. . . to SHEET

automatic, continuous operation!



Anger

First to Manufacture Rigid PVC Tubes Direct From PVC Powder

In 1950 Anger Company engineers perfected a new production method—and for the first time made it possible to create economical rigid PVC tube right from the basic powdered resin itself! Since then Anger has remained in the forefront of both research and manufacture of rigid PVC extrusion equipment—has designed and constructed many systems for large production requirements throughout the world.

A Complete Line of Warranted Machines and Equipment

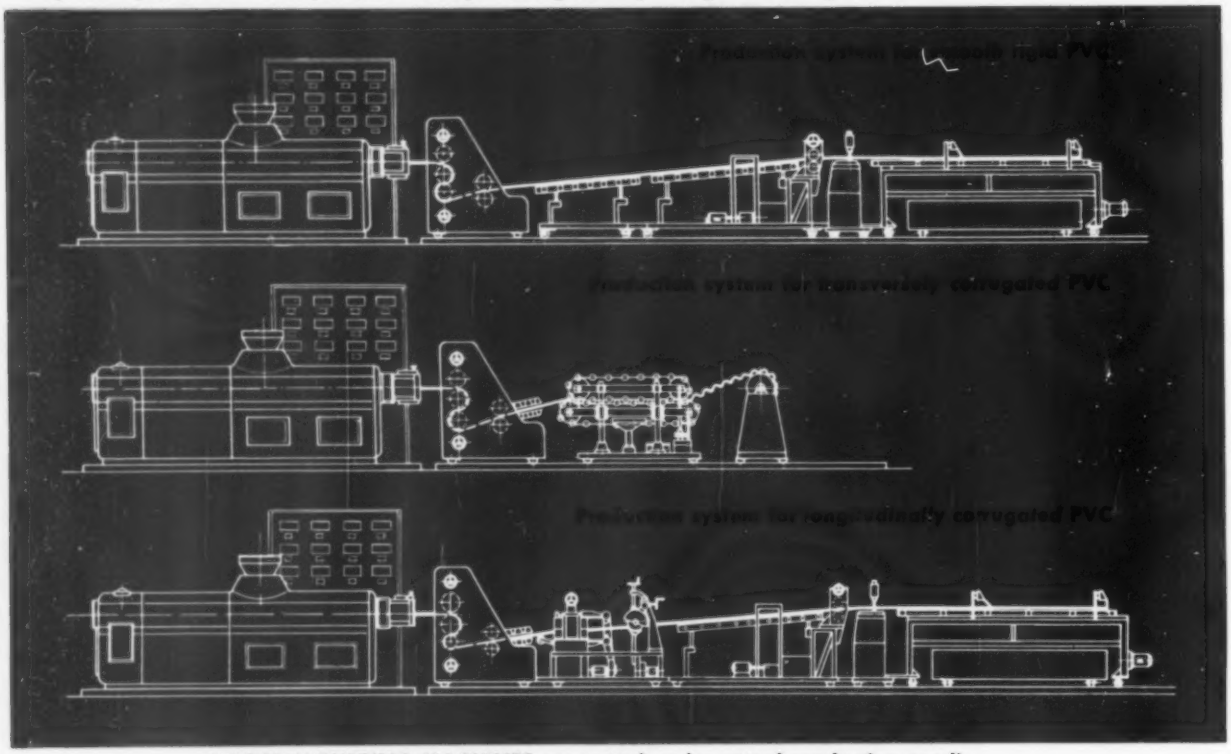
Designed and engineered to meet your custom requirements, Anger machinery and equipment extrudes direct from PVC powdered resin—eliminates compounding and pelletization—molds rigid PVC tubes, sections and plates—all in one continuous operation!

This Anger "direct route" means:

- **Utmost economy by reduced production costs and manpower**
- **Maximum product quality in strength, surface, etc.**

And . . . CORRUGATED SHEETS IN ONE OPERATION, TOO!

Latest achievement of the Anger research team: Development of complete extrusion lines for production of flat and corrugated sheets of rigid PVC—handle dry-blend mixture with no intermediate processing . . . produce quality sheeting at higher output, lower cost per unit. With APM standard extrusion machinery, plus two accessory units, you can produce all three—*plain, transversely* and *longitudinally* corrugated sheeting.



ANGER MOULDING MACHINES are tested under actual production conditions prior to shipment . . . are delivered with *full guarantee* and *warranty*.

Write or cable now for full particulars.

General Representation: ANGER Plastic Machines Ltd., Munich 23, Leopoldstrasse 18

Engineering and Construction: Wilhelm Anger OHG, Traun, Austria

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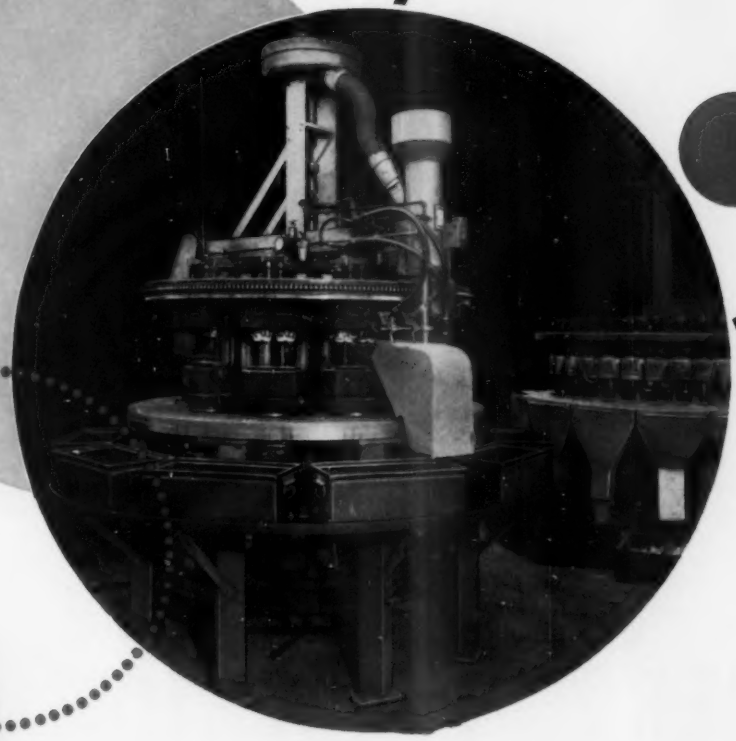


AUTOMATIC ROTARY PLASTIC MOLDING PRESSES

10- or 30-Station Machines

- Low cost simple molds
- Machine easily installed
- Simple ejection of parts
- Easily maintained
- Maximum flexibility
- Fully automatic compression molding
- Hopper feed – the supply rotates
- Adjustable production cycle
- Adjustable temperature in mold holders
- Low cost molding for small quantities
- Molds changed without production interruption

For descriptive bulletin or opportunity to see these machines in operation, contact

NEW ENGLAND BUTT CO.

Division of Wanskuck Co.

304 Pearl Street • Providence 7, R. I.

THREE NEW PHENOLICS FROM GENERAL ELECTRIC

G-E 12985 **This new General Electric compound is the very finest *heat-resistant* phenolic available in its cost range.**

12985 retains high flex strength after severe heat aging. It has a rich, black color which it maintains well on exposure to heat. The material has a drop impact strength higher than its best competitor . . . equivalent *for the first time* to a general-purpose compound. 12985 takes a hot, speedy preheat and cures rapidly. It has excellent machining properties, good chemical resistance, relatively low specific gravity (1.58). And—it is offered at an attractive price.

SUGGESTED USES: This superb high-temperature material is particularly recommended for handles on skillets and cutlery, for appliance parts, switch and lamp parts, knobs, wiring devices, miniature parts for use at high ambient temperatures.

G-E 12941 **A new concept in general-purpose phenolics: a fast-curing, ammonia-free, non-bleeding black compound.**

This material gives an extremely fast, blister-free, cold-powder cure. There is no danger of staining the mold or tarnishing costly silver contacts. Nor is there any need to worry about high scrap losses caused by uneven flow. Parts produced from 12941 will not bleed.

SUGGESTED USES: Ideal for small, automatically molded parts of all kinds: switch parts, contacts for wire connectors, closures, tube sockets, appliance control parts.

G-E 12942 **This new variant of a popular general-purpose compound offers added impact strength, improved finish and cure.**

A versatile and easily molded compound, 12942 pre-forms well, takes a hot preheat, and flows smoothly in the mold. Parts made of the new compound are smooth, rigid, deep-black, and will not embrittle during tumble finishing. It can be used in cold powder automatic molding with just a slight penalty in cure speed. It is not hand staining.

SUGGESTED USES: General applications such as handles, knobs, meter case covers, coffee maker bases, piano sharps.

These three new compounds may well give you an important advantage in processing or properties. General Electric offers you dozens of standardized phenolic compounds, including general purpose, heat resistant, shock resistant, and fast cure phenolics. Our Technical Service people will be glad to help you select the right material for your job. For more information, write to: General Electric Company, Section MP-561, Chemical Materials Department, Pittsfield, Mass.

Phenolics-first of the modern plastics...first in value

GENERAL ELECTRIC

CYCOLAC® BRAND

TOUGH, HARD, RIGID POLYMERS FROM BORG-WARNER

The ability to resist dents, scuffs, stains, water . . the durability to shrug off the knocks and shocks of air travel (even in cold weather) . . . the saleability that goes with lighter weight plus the look and feel of leather. These were the qualities Samsonite required for the shell of its trim, smartly styled New Horizon® luggage. CYCOLAC brand plastic—the tough, hard, rigid, virtually indestructible engineering material from Borg-Warner—came through in every case! If your product must travel a rugged road during its lifetime, investigate CYCOLAC brand polymers—better in more ways than any other plastic. Write Dept. M-10.

MARBON CHEMICAL WASHINGTON — MARBON B-W CHEMICAL — DIVISION **BORG-WARNER** WEST VIRGINIA

*CYCOLAC *is the registered trade mark of Borg-Warner*

From Plastene—a world of precision plastics...

For 15 years, Plastene Corporation has been supplying customers in virtually every field with molded plastic products fabricated to a single standard: Plastene Precision. Such prominent firms as The U.S. Time Corp. (Timex), Fram Corp., Sears Roebuck & Co., The American Thermos Products Company, Amity Leather Products Co. and Lily-Tulip Cup Corp. are consistent users of Plastene's products and abilities.

What does Plastene Precision mean? It means molds designed by Plastene and built to its rigid specifications. It means precise engineering and skilled fabrication through every step of the manufacturing process. And it means prompt, efficient service from plants located in three strategic geographical areas — Crawfordsville, Ind., Norwich, Conn. and Anaheim, Calif.

Plastene is equally noted for design leadership. Its prominent designers are recognized for originality and creativity and for their intimate knowledge of the characteristics and scope of polystyrene, polyethylene, acrylic, delrin, polypropylene, acetate and nylon.

Whether your plastic requirements are simple or complex, Plastene's unsurpassed facilities and skills can fill them. Why not write today for further information?

PLASTENE

Plastene Corporation, Crawfordsville, Indiana • Subsidiary of The American Thermos Products Company

Werner & Pfleiderer compounding machines

are the choice of more and more producers of **difficult-to-process** materials like **Acrylics, Nylon, Polycarbonate, Polyformaldehyde.**

The reason clearly is the often established superiority of our self-cleaning twin-screw design based on these features:

● **Color dispersion quality.** In low-melt viscosity thermoplastics, the shear action necessary for adequate pigment dispersion cannot be achieved with conventional screws due to high back flow. The forced flow in our twin screw machines with sealing profile allows to create in various zones exactly the required intensity and duration of shear corresponding to the material viscosity in each stage.

● **Devolatilization.** This is quite tricky with low viscosity materials due to the formation of films susceptible to gradual degradation on the unscraped surfaces of non self-cleaning machines. In Werner & Pfleiderer ZSK-machines, the self-cleaning action of the screws is maintained also in the decompression zones under the vacuum ports. Therefore no plugging-up of the vents will occur and the screw surfaces stay clean.

● **Clarity of material.** The average dwell time in a 3¼" diameter twin screw machine is, at an output rate of 330 lbs/h, only 55 sec., with the extremes ranging between 40 and 90 sec. For heat sensitive materials, one of the prime reasons for color development is thereby eliminated. Clarity can further be improved by feeding the material to the compounder with a slight moisture content. The evaporation of this moisture has a steam stripping effect, and at the same time permits to maintain a low and exact temperature level. This method can be applied in ZSK-machines since devolatilization in these machines is very easy and reliable.

● **Little production loss through down times.** The self-cleaning action of the screws permits color changes without dismantling the machine – just by feeding the new color – within ten minutes. ZSK machines can be started even when filled with material!

● **Any form of feed material.** Pellets, beads, flakes or powders can all be fed to ZSK-machines with reliable intake and uniform delivery rate

And last not least:
WERNER & PFLEIDERER have a lot of experience!

78A/61

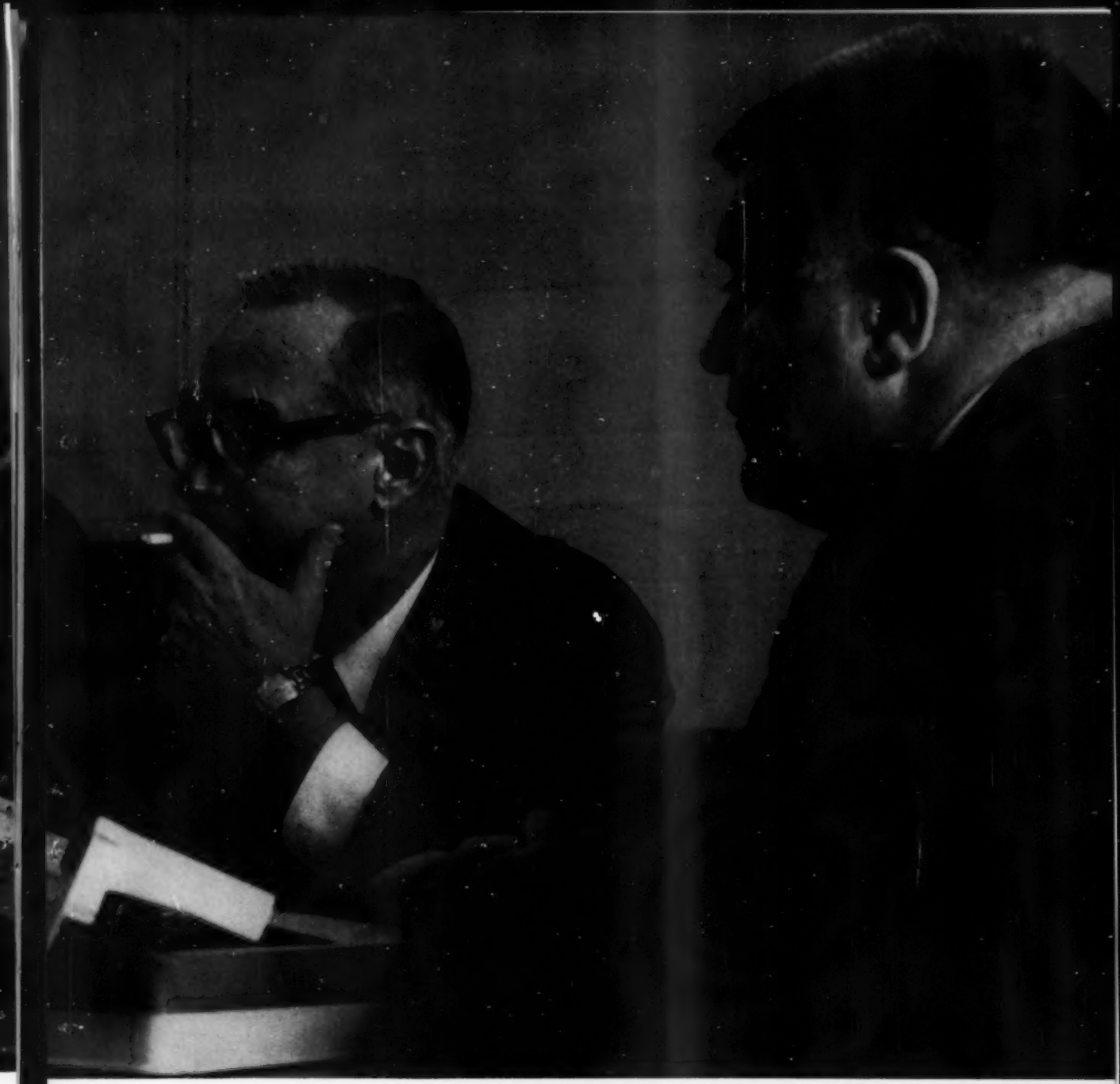
For further information please write or phone

WERNER & PFLEIDERER CORPORATION

500 5th Ave. New York 36, N. Y. Phone: LAckawanna 4-1226

A subsidiary of WERNER & PFLEIDERER, Stuttgart-Feuerbach, Germany

"Maybe this 132 years of plastics know-how can help solve <u>your</u> appliance molding problem," says Joe Foster.



L. to R.: Jack Iacoboni, Chief of Technical Service; Tommy Eyles, Chief Engineer; John LaBelle, Mgr. of Customer Service and Dr. Ray Hartigan, Dir. of Research, discuss solutions to an appliance manufacturer's molding problem.

That's the total amount of plastics know-how represented by the veteran production-design-research team you see in the above photograph.

These men, who have helped Foster Grant make major contributions to plastics progress over the years, are here solving molding problems in the production of home appliances. Maybe their recent successes with Fosta Tuf-Flex high-impact polystyrene in appliance mold design and production will suggest ways our resins – and our services – may be of value to *you*.

For instance – Fosta Tuf-Flex, our high-impact polystyrene is currently being used in volume for refrigerator inner-door liners and freezer doors.

Other current appliance applications for Fosta Tuf-Flex include refrigerator crisper trays and light-bulb shields intricately die-cast radio cabinets ice-crusher parts and electric can-opener housings.

What we give away is more valuable than what we sell. Why not put our many years of practical molding know-how to work on your product design, molding and merchandising problems? Call or write us today. Foster Grant Co., Inc. Leominster, Mass., KEystone 4-6511.

FG

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the few extra pennies that buy next year's vinyl business

We believe that these few pennies, invested in the right plasticizer, buy next year's vinyl business . . . the repeat business that stems from confidence in the consistent quality and performance of your product.

Why? Because these few additional pennies buy a proven low-temperature winner . . . Plastolein 9058 DOZ. We'll admit that cheaper low-temperature plasticizers appear tempting. But do they warrant putting the future of your business in jeopardy?

With time-tested Plastolein DOZ you are sure of lasting low-temperature flexibility . . . excellent heat and light stability . . . low volatility . . . unusually good "hand" . . . all the qualities that lead customers to buy (and buy again) with confidence. Isn't this your strongest appeal for next year's vinyl business . . . your best assurance of continued profit?

If you are not familiar with Plastolein 9058 DOZ, send for evaluation samples or full information today. Write Dept. F-10.

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MODERN PLASTICS

October 1961 **Volume 39, Number 2**

Let's stop this tradename nonsense!

Some young gentlemen from the Harvard School of Business made a survey of the possibilities for the increased use of plastics in the building construction field. It was a good survey, enlightening and enheartening, and is due to become part of our permanent marketing literature.

They found a few stymies to plastics' progress in building. These were matters of building code writing and interpretation, of self-extinguishing and flame-resistant properties in plastics, of creating acceptability and know-how of application among the building trades and crafts. These the industry already knew about.

But the biggest stymie they found was in the idiotically confusing plethora of similar-sounding tradenames in plastics.

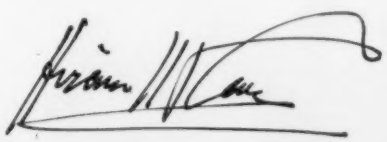
Every marketing survey we have seen indicates that future areas of increased plastics application lie in four major fields: construction, automotive and transportation, home appliances, and packaging, in that order. The difference between other markets and the "big four" coming up is that these big markets are based on engineering, on design for specific properties, on specification. And they are based on the principle that there will be two or more sources for the same material.

Two years ago MODERN PLASTICS spearheaded a campaign for the use of alphabetical nomenclature in body copy of articles and papers concerning plastics. Polyethylene is PE; polypropylene is PP; reinforced plastics is RP, and so on. This movement was based on the success of the same technique in the vitamin field. That principle is now accepted in the industry. But, to increase our volume in the four big markets of the future, we must now go much further. We must go by code numbers, indicating thereby the specific properties of the materials applicable to these fields.

Anyone who has attended sessions of the Building Research Institute and talked to leaders in construction knows how damaging this practice of compounding tradenames can be. What would happen if each new steel alloy, lumber grade, or cement formulation were to be given a different and fancy tradename by each manufacturer?

We suggest that S.P.I. and S.P.E. committees get together with similar committees from S.A.E., the Building Research Institute, and whatever body is concerned with refrigeration and home appliances to the end that we may replace tradenames with codes and numbers, and make some sense in specification of plastics.

Let's start to cooperate in plastics nomenclature with the sophisticated engineers and designers in the important markets now opening up to us!



New directions in urethane foams

With eyes fixed on a consumption potential of at least 400 million lb. of both flexible and rigid materials by 1965 and close to 600 million lb. by 1970, the urethane foam industry has already set the wheels in motion for an intensive market development program to extend over the next two to three years. And the prizes are rich!

Right now, it seems to be for the rigids that the really big marketing guns are being brought to bear. In the much larger and older field of flexibles (which will be covered in next month's issue), technology has pretty much been firmed up, market directions are more obvious, and the urethanes have already secured for themselves strong competitive positions.

In rigids, however, the picture is completely different. Here, much of the technology is still in a state of flux: many end-users have yet to evaluate some of the fascinating directions being taken in the way of processing techniques (*e.g.*, foam-in-place, spray-up, or frothing); polyethers, although new on the rigid scene, have already taken the play away from the polyesters and changed the cost picture; and the possibilities of true one-shot techniques are still lurking in the background.

And market potentials for the rigids haven't even been scratched! Although probably no more than 8 to 10 million lb. of rigid foam was used in 1960, today's producers are still confident enough to predict consumption of from 110 to 150 million lb. by 1965, and, even more surprising, 250 million lb. by 1970. Ultimate potentials, they further claim, are really staggering. The market goals for the rigids are lush ones—construction, transportation, and appliances. Given some breakthroughs in formulations and processing techniques and a better understanding of the material by end-users, rigid urethane foams have all the makings of a potential billion-lb. plastic!

Large users, small users

The excitement in rigid urethane, however, is based on more than just fantastic growth potential. Application ideas for the rigids seem to

Some radical concepts are

. . . in insulating techniques

Photo, Du Pont

RIGID URETHANE foam filling for masonry cavity wall was froth foamed in 130-cu. ft. cavity in only 25 minutes. Insulating factors reported twice as good as comparable materials. And an added bonus: shear bond action of the foam filling improves resistance to load, allowing increase in height of 10-in. cavity wall from 12 to 18 ft. without the need for additional structural steel as a support.

. . . in packaging ideas

Photo, Royal McBee Corp.

TYPEWRITER, enclosed in a 3-mil polyethylene bag, is placed in corrugated container and liquid foam components are poured into the box, foaming in place to fill the end cavities and form solid supporting blocks at either side. Estimated costs: one-fourth that of conventional wooden cases.

Part I: The rigids

rocket in from every direction—and the big surprise is in the diversity of industries and companies, large and small, that would appear to have a stake in rigid urethane foam's future:

- In suburban Pittsburgh, a builder of two new homes improves insulation and structural sealing and saves time with a unique approach: spraying rigid urethane on the sheathing inside the house (see photo, p. 85)—and in Watertown, N. Y., the city fathers spray the foam on the underside of a highway bridge to reduce the number of times the concrete bridge deck freezes and thaws, to avoid cracks in the roadbed.
- In the Midwest, a manufacturer of refrigerators increases storage capacity of a standard size unit by 35% thanks to the reduction in wall thickness effected with rigid foam cores—and on the West Coast, a trucker enjoys an additional 200 cu. ft. of space per 35-ft. trailer by switching from fibrous glass insulation to rigid foam.
- In Philadelphia, a manufacturer of contoured relief maps solves the problem of imparting rigidity to his product without significant increase in weight by using rigid urethane poured-in-place over the epoxy backing of the maps—and in Detroit, auto makers start evaluating a unique top assembly consisting of a stamped thin-gage steel outside skin, rigid urethane foam core, and a flexible urethane foam inner liner: rigidity, insulation, vibration-dampening, sound-proofing, and cushioning all rolled into one!
- In Washington, the Quartermaster Corps working on the revolutionary logistics concept of "buildings in a barrel" comes up with two radical quonset huts: one made up of foam sprayed over an air-inflated form (see photo, below) and the other consisting of a foamed-in-place rigid core between spray-up reinforced plastics skins (see MPI, Aug. 1961, p. 78)—and speculation arises on the possibilities for playhouses, summer "cabins," beach houses, farm shelters, and low-cost housing for underdeveloped countries.
- In the Midwest again, three rigid urethane chocks, molded in four man-hours and weighing

being developed...

. . . in low-cost buildings

URETHANE FOAM shelters can be made by spraying the foam over an inflated plastic film, allowing the foam to harden, then deflating and removing the film. Doors and windows can be cut out with a saw. Possibilities for the lightweight, portable units: hospitals, barracks or warehouses for the military; summer cabins; beach houses; duck blinds; construction sheds; and farm and ranch shelters. Photo, Allied Chemical

. . . in heavy-duty shipping

THREE RIGID urethane chocks molded in simple plywood molds in only 4 man-hours, support a 120-ton steam turbine generator. The 200-lb. chocks, with high strength-to-weight ratios, replace a 6800-lb. hand-built hardwood unit. Reported savings: up to $500 per shipment.

Photo, Dow Chemical

...and versatility in application

Foam-in-place in the shop . . .

PRE-DETERMINED AMOUNT of liquid foam ingredients is poured into the cavity walls of the wing section of a new type of radar-tracking and missile target. Massive jigs are used to prevent the thin metallic skins from buckling as ingredients start to foam-in-place, completely filling the cavity and bonding tenaciously to all interfaces. Foaming of the entire unit requires only 57 minutes. Function of the foam is to provide flotation characteristics so that target can be dropped intact into the sea and will float. Photo, Nopco Chemical

. . . or in the field

Photo, Polytron Corp.

FOAMING OPERATIONS begin on the floor of a cold storage warehouse requiring a high level of insulation. Finished surface covered a total of 15,000 sq. ft.—one of the largest of this type of job done in this country.

only 200 lb. each, replace a 6800-lb. hand-built hardwood unit in supporting a 120-ton generator while it is shipped halfway across the country (see photo, p. 83)—and in Pennsylvania, a manufacturer of curtain-wall panels finds the same outstanding strength/weight ratio makes his foam-filled panels stiffer, flatter, and less in need of expensive bracing or support.

- In New Jersey, a 35-ft., 135-passenger, steel craft with foamed-in-place urethane filling its voids proves the effectiveness of the material as a buoyancy member that can make a boat unsinkable—and from a Coast Guard report comes word of a foam-filled epoxy-glass mooring buoy that weighs only 900 lb., yet can withstand design loads of 42,000 p.s.i.
- In Hartford, Royal McBee, a manufacturer of typewriters, wraps the product in polyethylene film, places it in a corrugated carton and foams around it to completely fill the end sections and form rigid structural members; result: a functional package at 25% the cost of a wooden case (see photo, p. 82)—and down South, a manufacturer of case goods studies the possibilities of wrapping his products in polyethylene film and spraying the foam directly on the outside to make an integral, low-cost, and practical container.

Foam has much to offer

The reasons for this interest in rigid foam, the reasons why the number of end-users has grown from 75 to 1000 in the past five years, are not too hard to find.

As an engineering material, rigid urethane foam has several outstandingly useful properties. Critical to most of the applications described above is the foam's insulating characteristics. Fluorocarbon-blown polyether foam's K factor (representing the coefficient of thermal conductivity) is variously listed as anywhere from 0.11 to 0.16 for grades of 2 lb./cu. ft. density; as a point of comparison glass fiber, one of its near-

is the key to other uses:

Fabricate from slab stock

Photo, Caloric Architectural Porcelain

SECTIONS CUT FROM rigid urethane slab stock are fit into place on metal skin. Both metal and foam had previously been sprayed with adhesive. Sandwich will later be laminated under pressure of 6 to 8 lb./sq. in. to effect a lightweight, strong, flat architectural panel.

Spray it on inside . . .

Photo, Binks Mfg. Co.

RIGID URETHANE foam insulation is easily sprayed onto panel of sheathing in newly built house. When it hits surface, it expands to give 1½ in. of rigid insulation—with same characteristics as 4 in. of normally used insulating material. Technique simplifies application even in narrow spaces between studding, eliminates time spent in cutting blanket-type insulation.

est competitors, has a K factor of around 0.22 (the lower the K factor reading, the higher the insulating value). Added to this is rigid urethane foam's high compressive strength, its excellent chemical resistance, its outstanding resistance to moisture absorption, and its dimensional stability. Heat resistance of the foams is also good. Most of the rigids made from conventional isocyanates will perform satisfactorily in the 225-to-300° F. range. With specialty isocyanates, *e.g.*, Carwin's polymethylene polyphenyl isocyanate, rigid foams that retain up to 65% of their room-temperature compressive strength at 600° F. are possible.

But it is the variety of techniques by which they may be applied that makes the rigid urethanes really shine. Other materials may compete with the urethanes in some of their properties, but it is doubtful whether these can be poured in liquid form into a cavity or sprayed out of guns or shot out of nozzles like shaving cream out of an aerosol—and, if you want to keep to conventional techniques, urethanes can also be supplied in the form of slab or board stock.

Foam-in-place: In its simplest explanation, this technique involved mixing the liquid reactive components of the foam formulation together and pouring them into the bottom of an open cavity

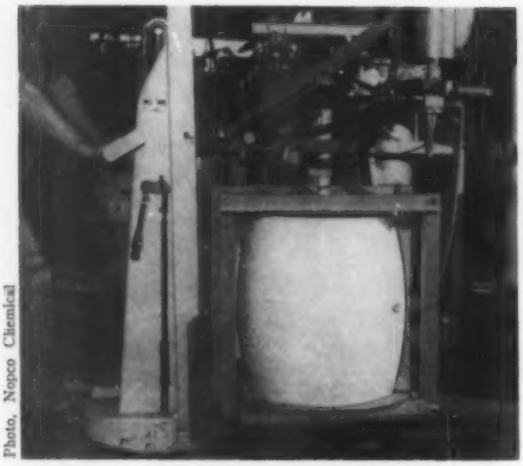
. . . or outside

RIGID FOAM is applied to brush-blasted, primed steel surface of 500,000-gal. caustic storage tank. Walls receive 1 in. of foam, roof ½ in. A fire-retardant mastic is then sprayed on the foam surface at a dried-film thickness of 10 mils. Applied application cost is about two-thirds that of a comparable insulation job using fibrous glass as the medium.

Photo, Wyandotte Chemical

Here are the big markets shaping up:

Cold storage insulation



Photo, Nopco Chemical

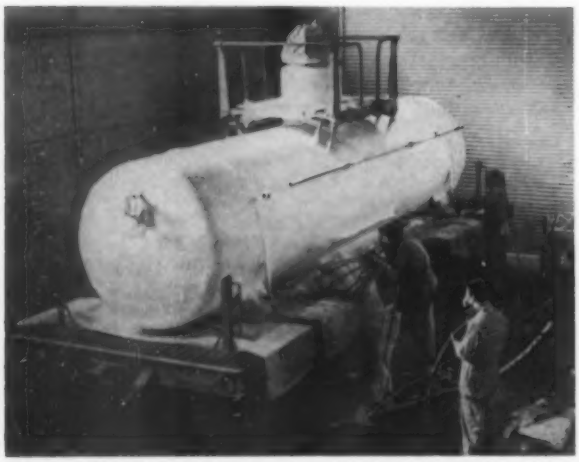
TAKING A CUE from the growing interest in rigid urethanes by household refrigerator manufacturers, producers of beverage coolers, freezers, ice-cream cabinets, and product display cases have started to run to the material. The dispensing barrel for soft drinks shown above is a typical example; the foam is poured-in-place to fill the cavity between inner metal ice-chest body and molded acrylic outer housing.

or mold. Within a matter of seconds, the mix begins to foam and rise, flowing throughout the cavity, filling all voids, and becoming an integral part of the finished product. As it foams up, the material adheres tenaciously to the wall surface—a feature which, incidentally, eliminates the need for internal supports or costly adhesives.

Mixing and dispensing the liquid ingredients in a foam-in-place application can be as simple as hand-mixing the components together in a bucket and pouring the contents into the cavity or it can involve more expensive mixing and metering equipment that dispenses the liquid foam ingredients into a cavity through a nozzle (costs for such equipment range from about $3000 for a portable unit that can handle about 20 lb./min. to $30,000 for an automatic job that can handle about 100 lb./min.).

Spray-up: Regarded as a gimmick of little commercial importance until about two years ago, spray-up techniques have suddenly blossomed forth as low-cost, functional means of applying the foam to boats, shelters, storage tanks, railroad tank cars, bridges, or any large and irregular surface that might present **(To page 168)**

Transportation



WHILE REFRIGERATED trailer trucks and railroad cars with rigid foam in the wall cavity will be major outlet, there is potential too for spray-on use of the foam as a protective insulating jacket for tank shells. In addition to obvious insulation advantages, rigid foam in this form is easy to apply, reduces painting maintenance, and is easier to repair in case of damage. Photo, Allied Chemical

Construction

RIGID CORE for curtain-wall panels has largest volume potential. Here a typical panel, with a ¾-in. core of slab stock and a porcelainized steel skin, is being installed in a new building. Advantages: panel thickness is reduced by 50%, with resultant savings in cost of frames and mullions; better rigidity and stiffness; can be laminated with Neoprene contact adhesives; moisture-resistant, vermin-proof, and odor-proof.

Photo, Pittsburgh Corning Corp.

POLYPROPYLENE:
what should the molder look for?

In our August issue, we reported on the development of polypropylene and on the current and future status of price and production capacity. In this, the second part of a three-part study, PP is considered as a molding material in terms of properties, processing idiosyncrasies, and the applications to which it is best suited

Molding has been the largest volume consumer of PP up to now and is expected to remain so for two or three years. Of the 70 to 80 million lb. of PP expected to be consumed in 1961 it is estimated that 20 to 30 million will be for molding. Of the 500 million lb. or more of sales hoped-for in 1965, perhaps 150 million lb. will be for molding. This, of course, is only a guess and could be easily varied by unforeseen developments that nearly always becloud the future in plastics prognostications. Perhaps it should be regarded as a target figure rather than an estimate. There is some reason to believe that the target figure may be low, but 1965 is little more than three years away and it requires time for a new plastic to be established in large volume quantities.

There are various problems to be overcome in producing and processing PP just as there were in polystyrene, cellulose acetate, acetal, acrylonitrile-butadiene-styrene resins (ABS), and others. The success of molders in recognizing and anticipating these problems, and the success of producers in providing them with needed formulations and the technical information needed for proper materials selection, will greatly influence whether the industry reaches or falls short of the target figure.

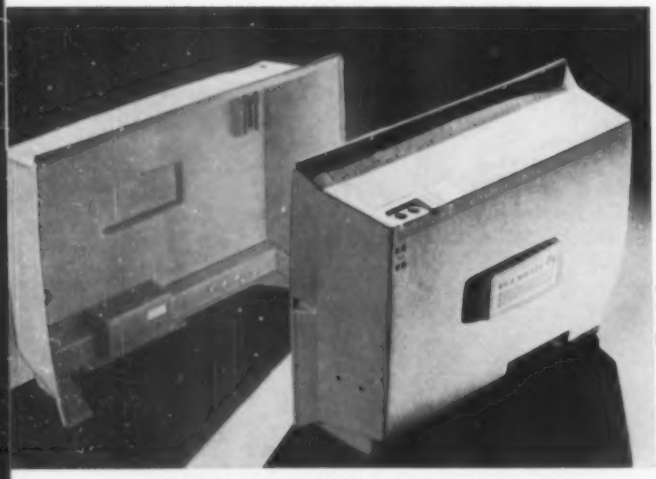
A false impression was once circulated that PP could be molded in "any old mold with no trou-

INTEGRAL HINGE made possible by PP's ability to withstand flexing is put to work in this urethane foam-padded box for optical lenses. Design concept incorporated in hinge has already been applied to accelerator pedals, toilet seats, tackle bits, etc. Photos, Eastman Chemical

What will PP replace?*

Application	Material replaced
Mop squeezer	Metal
Lid—pouring lip	Glass
Can opener housing	Metal
Vaporizer components	Glass
Eyeglass case	Paper
Bookbinder	Paper
Beakers and funnels	Glass
Dishwasher basket	Coated steel wire mesh
Outboard motor engine	Steel, aluminum, high-impact styrene, HD polyethylene
Paint handle	Wood
Lawn mower hood	Metal
Bookcase	Wood, metal
Pipe fittings	Metal
TV back	Metal
Cosmetic jar	Glass
Cutlery handle	Cellulose
Carafe	Glass, stainless steel
Male urinal	Metal
Rope	Manila
Outdoor-chair webbing	Saran
Pipes	PVC, metal
Nozzle (auto window defrosters)	Metal

*Recent examples of new use for PP, from the files of AviSun Corp.



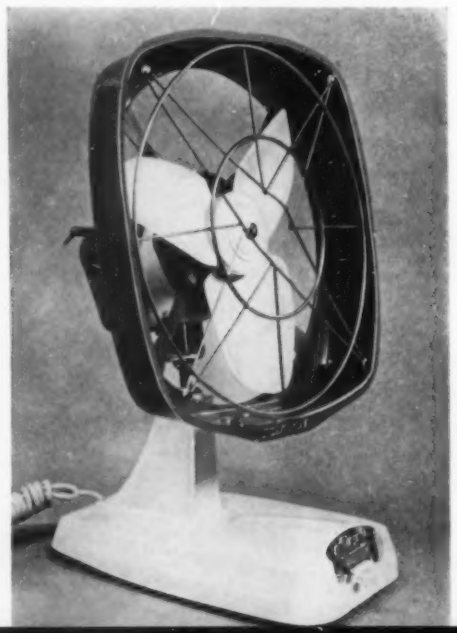
Photo, Eastman Chemical

IMPACT STRENGTH and heat resistance of PP have won it an important place in back panels for TV sets. Stippled molded-in texture heightens material's resistance to marring scratches.

bles at all," but molders soon found out that that wasn't true. Compared with other materials, the molding and extrusion of PP requires different temperatures and pressures, shrinkage is quite different, gating must be done to fit the job at hand, thick sections require special care, and coloring technique is different. In short, all the usual changes in switching from one plastic to another must be mastered. Furthermore, there is the inherent problem of PP's cold-temperature brittleness, which requires special designing in some instances, and the problem of stabilization, which was emphasized in Part I of this series.

However, PP has such superior properties when properly handled that there can be little doubt of its eventual widespread adoption. Furthermore, there has been comparatively little "molecular tailoring" by the producers to make it fit the more unusual needs. The problems to be pointed out later in this article are not insuperable—but they do exist and the molder must face up to them.

Because PP was so widely heralded as the first stereospecific plastic—one which could be tailored to meet specific requirements—one may ask why all the bugs can't be ironed out. No such miracle is ever likely to happen. A plastic produced by a stereospecific system could possibly be likened to a Thoroughbred race horse. There are all kinds of horses, from palominos to Percherons, but the Thoroughbred is the epitome of speed, beauty, and "class" in horseflesh. Despite his fine quality, he is high spirited—may at times be cantankerous, mischievous, devilish and temperamental. And he's not designed for pulling a plow or drawing a wagon. Similarly, polypropylene may not be used for everything and it may at times



Photo, Montecatini

ENTIRE HOUSING and blade of fan are molded of PP. Because blade is molded in one-piece, costly assembly and balancing operations required with metal unit are eliminated.

CHEMICAL INERTNESS of PP makes it a natural material for molded closures for drugs, pharmaceuticals, and cosmetics. Because PP will hold a given torque, such closures can be molded without liners.

Photos, Hercules

give a temperamental performance while being processed—at least until the handler finds out what's wrong. But in its field it looks as though it is potentially a Thoroughbred—will do its work where it is expected to with class and distinction.

In the category of properties that make PP so potent a prospect for popularity and usefulness is *price*. As pointed out in Part I, the price is now 42¢, but all signs point to it being lower by 1965. It is this eventuality which makes it hazardous to guess how much PP molding material will be used in 1965 or even to guess how fast it will grow. It would be hard to hold back expansion even at present price levels, but if consumption does get up as high as a 100-million-lb. volume at current prices, there will be some surprised executives around the country. On the other hand, capacity for PP is scheduled to be 500 million lb. or more in 1965. If demand doesn't keep pace with supply heavy price cuts seem inevitable—at least if PP follows a traditional pattern in plastics history.

SQUEEZE TUBE of PP uses injection-molded shoulder and neck welded to an extruded body. The material's superior vapor and oil barrier properties will widen markets in this area.

A plethora of properties

Generally speaking, PP for injection molding has a combination of properties not previously available in one, single thermoplastic material. It has a high softening, or heat-resistance, point in use that permits it to withstand autoclaving at 20-lb. steam pressure over two hours. It is the lightest weight of all plastics. Although it is not quite as glossy or hard as polystyrene, it still has good glossiness and hardness as well as almost unexcelled strain resistance. Its flexural strength is a most valuable property and makes possible its use in fabricating thin walls. Its almost unlimited flex life makes possible the molded-in hinge—a surprising attribute in a material with the aforementioned stiffness. Stress-cracking is practically nonexistent in PP for rather long periods of time. It also has excellent electrical properties and its chemical resistance is as good or better than any other low-cost plastic.

However, in the strength category it is very notch-sensitive. A notch is literally the beginning of a break—even iron is sensitive to a notch or scratch to a certain degree. Glass is noticeably so. It's the spot where stress can be applied or concentrated. A square corner localizes a notch point; therefore a rounded corner of radius in PP, as in most any material, distributes the stress and helps prevent a possible break.

One producer points out that the best answer to both notch-sensitivity and cold-temperature brittleness is mold design and that the molder must watch his temperatures—he should never go over 525° F. in an attempt to get ridiculously high production rates, although even more problems may arise if stock temperature is too low. (Extruders don't often extrude at over 400 to 425° F., so should have no heat problems. When higher temperatures are used for film or monofilament

extrusion, the PP is specially stabilized to meet that requirement.)

The use of PP for molded built-in hinges has been widely publicized for such applications as hinged boxes, fishing tackle kits, toilet seats, etc. This ability of a stiff material to withstand flexing is expected to account for many applications that would otherwise go to other materials. The most outstanding application incorporating the hinge concept is probably the auto accelerator pedal; in this instance, it makes it possible to mold the pedal in one piece, eliminating the many parts and costly assembly required in the conventional pedal. There are at least 15 other types of hinge applications now in production.

But this flexing characteristic is not automatically obtainable; although inherent in the resin, it must also be carefully designed into the product. Too thick a section makes it difficult for the hinged sections to fit together. Also, the first flex should be made while the hinge is still warm.

Melt flow rates important

Polypropylene is often advertised as a material that flows into mold cavities more readily than most other thermoplastics due to its sharp decrease in viscosity at its melting point. This property is especially valuable when difficult-to-fill molds are being run. The rate of melt flow can be varied by the producer according to the needs of the fabricator, who may need a different flow rate for every major item he molds. The flow rate may vary from less than 1 to 18 (the lower the figure, the stiffer the melt). Each company has various grades that vary from a very low to a very high melt flow. In general, grades offered are approximately as follows:

General-purpose injection molding grades offer melt flows of around 3 to 4.5 that give good toughness and strength in such applications as hinged boxes, automotive radio grilles, textile bobbins, handles, haircurlers, and battery caps. Another type in this area is designed for use where prolonged heat resistance is necessary, as in backs of TV sets, appliance parts, and hospital and laboratory ware. One company offers a material with a melt flow of 18 that is useful for hard-to-fill parts where less impact strength is needed, such as syringe components or container tops. In between, there are melt flows of 6 to 9 which permit rapid-cycle production of such complex pieces as lipstick tubes and thin-wall containers. One company, at least, offers a low-melt-flow grade of 1.5 for extrusion and an extra-low-melt-flow grade of 0.75. In general, PP with a melt flow of 2 or 3 processes in a manner similar to polyethylene with a melt index within the range of 8 to 10.

Then there are the higher-impact grades that are modified with varying quantities of rubber (*e.g.*, the polyisobutyl-modified material for luggage cases) and which have a melt flow of around four. These grades are used for chair seats, notebook binders, brief cases, tote boxes, fishing tackle boxes, and portable carrying cases.

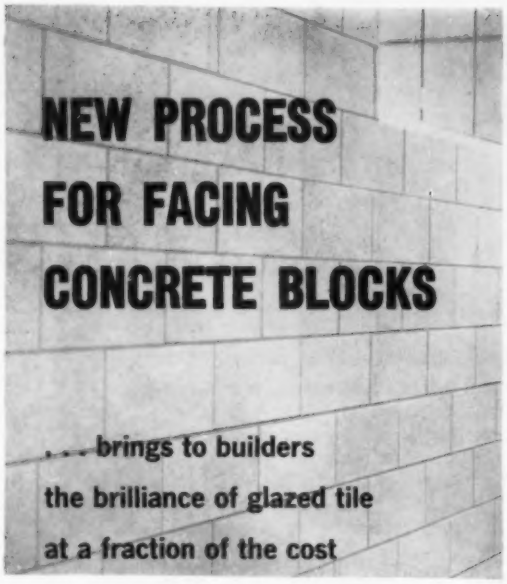
It is said that the tendency in Europe, where there are more screw-type injection machines, is to mold with melt flows as low as 0.2 and 0.7 that can be handled on such equipment.

Photo, AviSun

HOUSEWARES, a top, market for plastics, are being eyed by PP producers. Cups, dinnerware, and crispers taking advantage of PP's toughness or heat resistance should be first volume use.

Melt index vs. melt flow

Producers ask that a distinction be made between melt index and melt flow. The former should be applied only to polyethylene, the latter to polypropylene. Both terms refer to the rate of flow of the materials but the rates are measured somewhat differently. In neither case is the melt flow or melt index exactly the same from producer to producer, but the same number, say 4, is relatively similar. Thus a molder using a 4-melt flow material of Producer A can probably safely buy another 4 from Producer B, **(To page 186)**



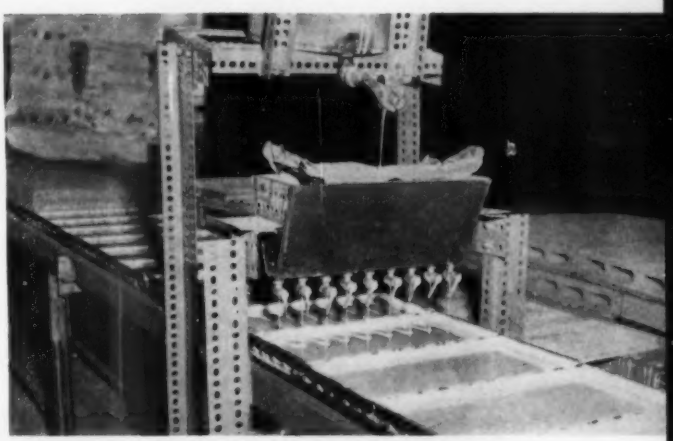
Highly glazed polyester-faced cement blocks are plastics' latest achievement in their steady penetration of the building market.[1] These blocks have a degree of lustre that is about the same as that of glazed tile, yet on an installed basis cost only two-thirds as much. The exact price structure will vary from location to location. But in a representative installation of an interior corridor at a North Carolina elementary school, the figures ran as follows: polyester-faced block, 8 by 8 by 16 in., $1.30/sq. ft., installed; structural glazed tile, 8 by 5⅓ by 12 in., installed—$1.80/sq. foot.

How they are made

Key to the new block is a three-layer molding procedure, involving the use of a gel coat to provide the highly polished surface. The first layer consists of a clear, transparent polyester gel coat applied to the mold (a shallow pan slightly larger than the area of the cement block face) by spray-up. This layer is partially cured by passing under a heat bank. The next step consists of automatically sprinkling over the gel coat any one of a group of decorative aggregates, including metal flakes and chips, oyster shell, marble, vermiculite, etc. After the decorative effects have been dispensed into the mold, two additional layers of polyester resin are charged into the pan in premetered amounts. The first of these is partially cured through a combination of heat and catalyst. The final layer acts as the bonding agent between the previous layers and the cement block itself. The cement block is placed into the mold while the final layer is still in the liquid stage. The entire assembly is cured over-night.

This process is covered by a patent owned by The Glidden Co., Cleveland, Ohio, and licensed to National Plastics Co. Inc., Martinsville, Va. National, in turn, licenses block producers in the United States and Canada to make and sell the coated block under the trademark Decor-Glaze. Blocks are said to be suitable for both indoor and outdoor application. Cost of getting into production, according to National, ranges from $5000 to $15,000, depending on degree of automation.

Because the economics of shipping concrete block limit the effective supply radius to 50 to 80 miles, distribution will be through strategically located franchised producers. Already 10 companies have been licensed. Polyester resin is supplied by The Glidden Co.—**End**



AUTOMATIC DISPENSER discharges predetermined amount of polyester resin into pan mold, which has previously been sprayed with a transparent gel coat, onto which have been placed metal flakes, shell, or other decorative effects.

HEATER BANK partially cures layer of polyester resin. After another layer of resin has been added, the cement block is placed into the mold and the entire assembly cured over-night.

[1]For earlier developments in this particular field see "How builder can profit with polyester-faced concrete," MPI, May 1959, p. 102, and "New tools for builders: spray polyester," MPI, August 1959, p. 76.

SWITCH FROM METALS TO PLASTICS CUTS COSTS

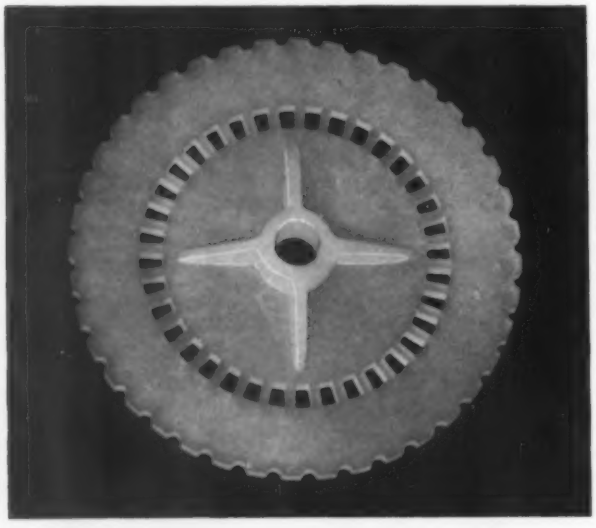
Manufacturer of business machines effects impressive savings on many of the 500 parts on which it does its own molding. Here are the resultant economies for six representative parts

The Burroughs Corp., a leading manufacturer of business machines ranging from a desk-top calculator to complex data processing equipment, seeks to use plastics in place of metal wherever practical in its products. In some switch-overs the company has reduced the cost of parts by as much as 90 percent. Such cost cutting techniques are, of course, not limited to business machines, but can be applied to other industries.

Illustrated here are six parts which were switched from metal to plastic, with details on the resultant economies. Not easily shown, however, are other factors which helped make such achievements possible. These include plastics experience, which began in 1909 with fabrication of cellulose nitrate and has grown into a full-scale captive molding operation that produces approximately 85 to 90% of all plastics parts used in Burroughs machines.

The molding facilities located at the company's plant in Plymouth, Mich. include: ten injection machines of 3- to 6-oz. capacity, two double-shot machines, and seven compression and transfer presses, and complete tool room facilities.

Production consumes in excess of 100,000 lb. of plastics annually. One big item: two-color, double-shot molded keybuttons of cellulose acetate butyrate, 6 million of them per year.—**End**

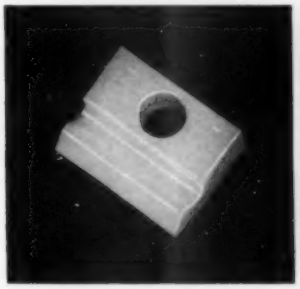


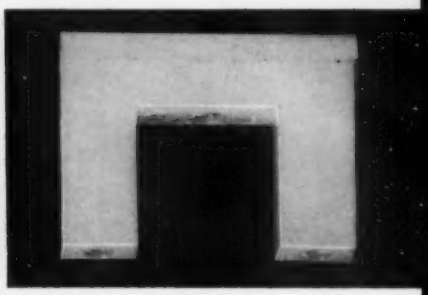
1 **Part FC 189-1** is a nylon ratchet wheel which when rotated adjusts a clamping mechanism on a metal paper chute or guide. It is turned by hand to provide desired adjustment. Part is produced in a four-cavity mold. Previously, this component was composed of two die-stamped steel parts with a screw machine-produced hub spun into it, then chrome plated. Savings over metal: 75%.

UP TO 90%

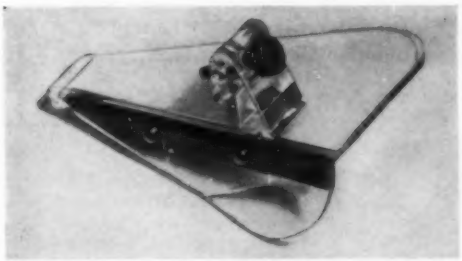
2 **Part FT 86-3** is another type of ratchet for a release mechanism incorporated in many Burroughs machines. Previously made of steel, it involved die stamping, two forming operations, drilling and counter-boring, plus plating. The nylon part, Burroughs reports, actually out-performs its metal predecessor, with wear points holding up better. Savings over the metal part: 95%.

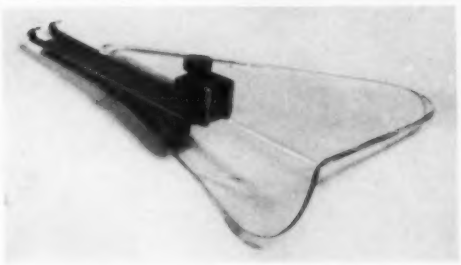
6 COST-CUTTING CASE HISTORIES





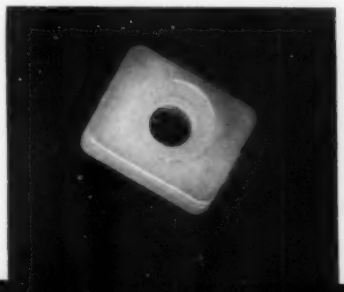
3-4 **Part FC 151-1** is a paper guide clamp, also used on a number of Burroughs machines. **Part FC 148-1** (right) is used in conjunction with it. Together, these parts clamp over a metal stamping and provide adjustment for width of paper. Both these components, of nylon, are produced in two-cavity molds. Formerly, this assembly was fabricated of aluminum, by forming and milling bar stock. Production involved polishing plus the forming and machining operations. Saving over metal parts: 65 and 85%, respectively.



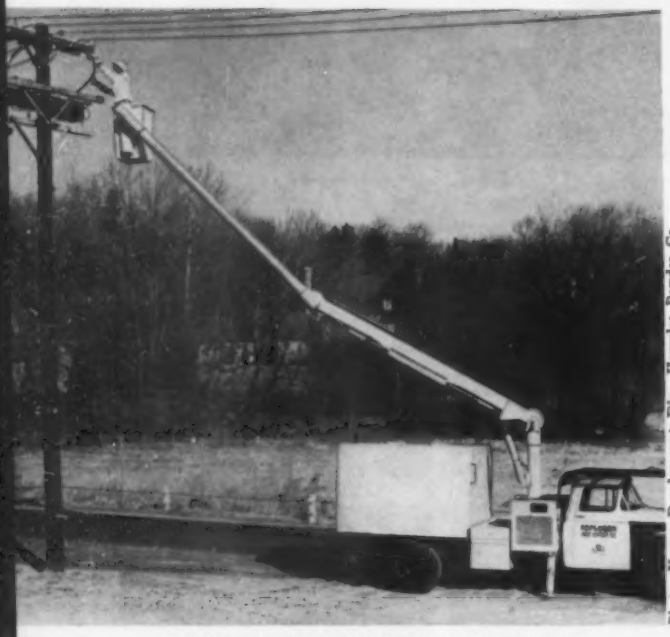


5 **Part 1FC1OZ-1,** molded of transparent acrylic material, is one of several paper form guides that have also been switched from metal to plastic construction, producing some interesting cost comparisons. On this component, when the transition to plastic construction was made, the part was redesigned to incorporate the hanging tab as an integral unit, eliminating an assembly of four metal parts and producing a saving of 73%.

6 **Part FC 288** is a molded nylon nut which assembles to a powdered metal part. Used on various machines in large quantities, it is produced in a 9-cavity mold, then the internal threads are produced by a tapping operation. This approach eliminates need for costly unscrewing mechanism in mold, which would also hamper production cycle. Previously, this was a machined steel part made from extruded stock, involving milling, drilling, tapping, and plating. Savings over metal: 90%.



FILAMENT WINDING



Photo, Young Development Div., Hercules Powder Co.

TRUCK-MOUNTED BOOM used in utility repairs or for tree surgery is filament-wound of epoxy-glass. Dielectric properties of material, combined with strength and light weight, indicate new approach to design of ladders, light poles, switchgears, and similar equipment.

Considering the heavy investment which industry has in the use of filament winding techniques strictly for military, rocket, and missile use, it is surprising that anyone has noticed, let alone experimented with, the technique's commercial possibilities. Perhaps the very fact that they have —and that filament wound commercial products are on the market today—is the best testimonial one could find to filament winding's versatility and ultimate large-volume potential.

Biggest-volume breakthroughs to date have been in areas of storage tanks and of filament-wound epoxy-glass tubing (as competition for conventional high-pressure laminate tubing). Shotgun barrels, pipe, aerial booms, and battery cases are typical of some of the other products already on the market—and railroad tank cars, automotive parts, and boats are some of the more interesting items in the offing.

For the resins involved, epoxies in particular, these markets can turn out to be big ones. By the end of this year, it is estimated that about 2 million lb. of epoxies will go into filament-wound applications. By 1964 or 1965, total markets may be up around the 10- to 15-million-lb. mark and, if some of the potential applications

Photo, Owens-Corning Fiberglas Corp.

OBVIOUS commercial adaptation of the technique is in storage tanks and vessels, such as this unit, with high strength-to-weight ratio and outstanding corrosion resistance.

GOES COMMERCIAL

COVER: Symbolic photo indicates how winding technique is funneling down from rocket tubes and pressurized fuel tanks to such civilian uses as railroad tank cars. Samples for photography supplied by Owens-Corning Fiberglas Corp. and by the Union Carbide Corp.

in the works—especially those in the automotive field—break before then, total consumption could be considerably higher.

Why use it?

In light of the publicity attendant on the use of filament winding by the military, most end-users are already familiar with the properties and characteristics of a filament-wound structure—the high strength-to-weight ratio, the very low modulus (stiffness), the resistance to corrosion, the outstanding electrical properties, and the self-dampening characteristics. Less well known are the economies which the process represents.

The basic theory of filament winding is, after all, a relatively simple one: wind parallel bands of fibrous glass roving, either pre-impregnated or run through an impregnating bath of resin, over a rotating mandrel in a predetermined pattern to develop ultimate strength. (See "A guide to winding," MPl, Aug. 1960.) Because of the repetitive nature of the rotational control variables, this means that the process is highly adaptable to automated, mass-production processes—more so than any other available method of reinforced plastics molding. Production equipment is available today that can run off an average of 500 linear ft. of glass per min.—and speeds up to 1000 ft. per min. are possible. Mandrels have also grown larger and larger to the point where some in use today are 60 ft. long and 20 ft. in diameter.

Add to this mass-production concept the fact that the fibrous glass roving used is one of the less expensive forms of reinforcement and comprises anywhere from 70 to 90% of the finished structure—and you get some idea of why commercial producers are suddenly discovering the technique. With development groundwork already laid by the military, with lower performance requirements than needed for military use, and with bigger markets in sight, some of the commercial products available today (*e.g.*, storage tanks) have

FILAMENT-WOUND undercarriage for plane manufactured in Sweden has better shock-absorbing and damping properties than conventional undercarriages, minimizing bouncing.

Photo, Owens-Corning Fiberglas Corp.

PIPE for extreme pressure and temperature applications in petroleum production makes use of core of wound glass fibers bonded with butadiene-styrene resin. Core is claimed to greatly increase strength properties.

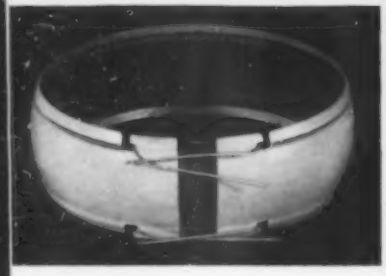
Photo, Enjay Chemical Co.

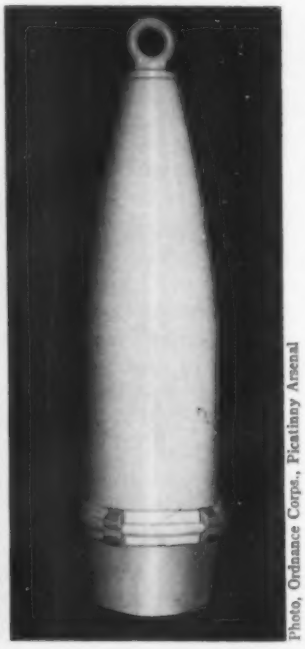
costed out as low as $1 to $1.10/lb. of finished product; on some of the larger-volume uses expected this year, costs may go down to approximately 70¢/lb. of finished product.

To date, of course, there has been the obvious design limitations in the use of filament winding. The technique, by definition, is best-suited to the manufacture of cylindrical tank-type structures, with or without end closures, and of open-ended tubular members such as pipes, ducts, booms, masts, etc. More recently, interest has been shown in a filament-wound prepreg-type material. The prepreg is created by winding the impregnated roving onto a mandrel, then slitting it off longitudinally and flattening it into a sheet that can be molded into intricate contours with conventional bag or matched-metal molding techniques. Result: a reinforcing form that offers predetermined orientation for greater strength, an increased glass content, and, because of the absence of over-and-under weaves, greater drapeability.

. . . and here are the coming markets

GROMMETS for use in shipping and storing artillery shells are being investigated by the military. Filament-wound glass-polyester-unit (top) would replace paper-board lined steel grommet with wire ties (bottom), is stronger, easy to apply and use.



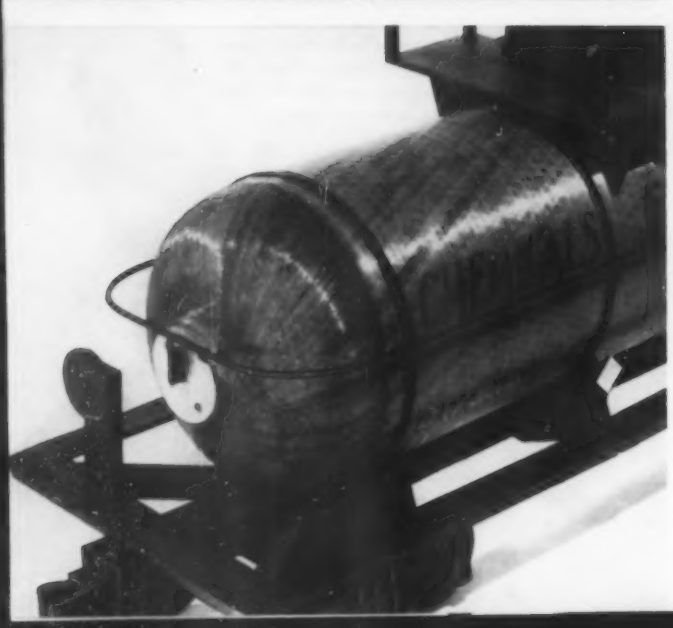


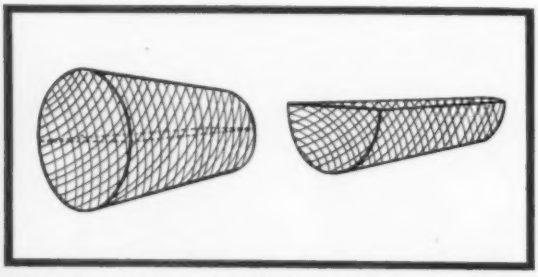
Photo, Ordnance Corps., Picatinny Arsenal

Products now in use

Conventional filament winding techniques have already given birth to a number of new products. In a take-off on the use of the technique for pressure vessels and for rocket motor cases, one of the first wound commercial products to be marketed successfully was huge storage and processing tanks for chemicals, oils, or other corrosive products. Although their initial prices were about equal to those of lined galvanized steel tanks, the wound RP structures had the added advantage of lighter weight, less maintenance required, and outstanding corrosion-resistant performance. Design shapes available today range from conventional cylindrical forms to perfect spheres (photo, p. 94; manufactured by Justin Enterprises Inc., Cincinnati, Ohio).

In another take-off—this time stimulated by the very high burst strengths achieved with filament-wound pipe for industrial use—glass-epoxy tubing made by the technique has been put on the market by many of the major high-pressure laminators (*e.g.*, Taylor Fibre Co., Spaulding Fiber Co.). And the product has already started to move into volume use for circuit breakers, switchgears, high-voltage fuse tubes, and a variety of other applications in the electronics, **(To page 194)**





MODEL of tank car (left) indicates feasibility of using the filament-wound glass-epoxy technique. Car is shown in full on cover. Filament-wound boats are also under evaluation. Artist's conception above indicates how radome-type structure could be wound, then cut in half to create two boats. Photo, Union Carbide Corp.

PE TAMES NEUTRONS

On the land and in and under the sea, polyethylene's unique ability to slow down products of nuclear fission have won it a market estimated at close to 2 million lb. per year, and the advent of atomic-powered aircraft promises a vast increase in this proven application

MISSILE-BEARING nuclear-powered sub of this class uses thousands of pounds of PE sheeting to guard crew from reactor's neutron emissions.

The advent of nuclear-powered vessels, such as the growing submarine fleet and the merchant ship *N. S. Savannah,* has created an important new use for polyethylene: shielding against neutron radiation (See "How PE shielding works," p. 98). Already, consumption of polyethylene (PE) sheet for shielding in surface vessels and submarines is estimated at 1½ million lb. a year. And future prospects are vast, especially when the possibilities of nuclear-powered aircraft are considered.

Both high-density and low-density sheets are used. High-density is slightly more effective, but the low-density material is more often used because of its lower price. Both types share two advantages over other materials—low weight and high rate of neutron shielding effectiveness.

For example, concrete, which in equal volume weighs approximately 2½ times more than PE, is out of the question for shielding on ships and planes. Water, like concrete, is an efficient neutron barrier, but it too is heavier than PE in equal volume and in addition it requires a weight-adding container. Also, a greater thickness of water and concrete is required to do the same job as PE (see chart on p. 98). Lightweight paraffin wax shields have been tried, but their use is limited since the material, with its low melting point, is extremely difficult to handle.

There are other important reasons why PE is a desirable shielding material. It has good dimensional stability and form retention, and is resistant to abrasion, impact, and shock. Polyethylene also has sufficient temperature resistance for most shielding applications (in nuclear submarines, for example, reactor temperatures are said to be relatively low), and the material will not give off noxious gases in the event of a fire. Finally, PE, particularly the low-density type, is relatively easy and economical to machine.

Application poundage is high

Nuclear reactors of any type or size are expensive devices, and considerable engineering know-how is involved in their construction. Thus, in terms of number of reactor units, there is not yet a sizable market for PE neutron shielding. But PE sheet suppliers have been encouraged by the fact that individual reactor installations have shown large-scale usage of PE on a poundage basis—one recent estimate places the current

annual requirement of PE sheet for neutron shielding at between 1½ and 2 million pounds.

An idea of the reasons for this volume estimate can be seen from the following: nuclear submarines carry tens of thousands of lb. of PE in the form of secondary neutron shielding, the *N. S. Savannah,* world's first nuclear-powered merchant ship, uses about 250,000 lb. of PE in its shielding; and the nuclear-powered *U. S. S. Long Beach,* a guided missile cruiser, is estimated to carry an even greater quantity—approximately 500,000 lb. of polyethylene!

The major reason behind the high poundage totals in these ships is the thickness of the individual shielding panels. In submarines the shielding, built up of panels 1 in. thick, measures from 6 to 14 in. thick. On the *Savannah,* the neutron shield is approximately 8 in. thick, and is composed of panels ¼ to 1 in. thick.

How PE shielding works

The radiation encountered in nuclear reactor operations takes four basic forms: alpha and beta particles, gamma rays, and neutrons.

Alpha radiation control can be effected by means of a piece of paper, a thin plastic film, or even by a few inches of air. Beta particles, while more penetrating than alphas, still do not require more than ¼ to ½ in. of shielding, which is usually in the form of a metal box, with a window of acrylic or leaded glass if visibility is a requirement. Shielding against gamma radiation requires, ideally, a very heavy and dense material, such as lead, uranium, or iron. But at land-based installations, concrete, earth, and water are more often the materials used, because they are relatively inexpensive. All plastics materials, PE included, lack the required density and are of no value by themselves as gamma radiation shielding.

Polyethylene's particular forte is the control of neutron radiation. Neutrons, products of nuclear fission, are highly penetrating, fast-moving, and erratic, caroming like billiard balls. The trick is to slow down these rays to a low-energy or thermal state, at which level they can be absorbed by a suitable material. It has been found that the best way to blunt the energy of rapidly moving neutrons is to present a high concentration of light-weight atoms as a barrier to their movement. Since hydrogen is the lightest atom, PE, possessing two hydrogen atoms per molecule, is clearly an ideal choice for the neutron barrier material.

Absorption of the slowed neutrons is usually accomplished by boron or cadmium fillers in the polyethylene. These materials are desirable because of their high rate of neutron absorption, or high "cross-section" as it is termed. As a rule, from 1 to 6% by weight of boron or cadmium filler is combined with the polyethylene.

Extrusion techniques "classified"

The precise technique by which the PE panels are extruded is a closely-guarded secret. However, it is known that die design, extrusion control, and take-off equipment are specially adapted for the production of heavy-gage sheet up to about 1½ in. in thickness. Extruders producing the thick PE sheet for radiation shielding can supply it in widths from 36 to 48 in. and in any desired length. As a rule though, easy-to-handle lengths from 5 to 8 ft. are used in shielding applications. The thick sheet is cut to length by special saws.

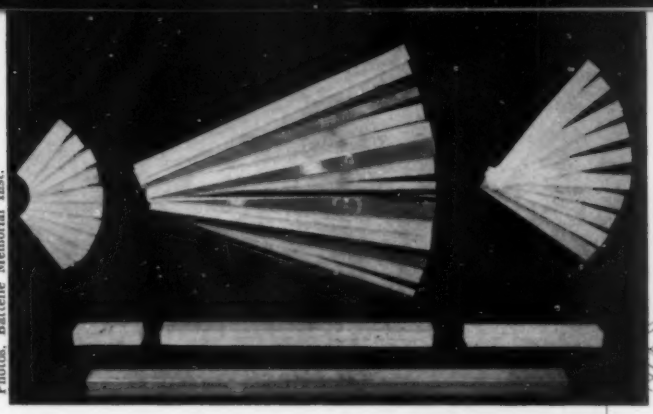
It is also known that one supplier is using 6-in. extrusion machines with 20:1 L/D ratios. Trimming and sawing operations are performed in line with extrusion. The PE sheets produced by this supplier are held to gage tolerances of $\pm 1/50$ in. and $\pm 1/32$ in., respectively, on the 1- and 1½-in.-thick sheets.

The *N. S. Savannah* uses well over 50,000 sq. ft. of low-density PE sheet for neutron shielding, the majority of it in 1-in. thickness. Primary shielding, against neutrons and other types of radiation, consists of a 6- to 8-in. layer of lead, made up of several individual slabs. The slabs are bolted to the steel shell of the reactor by steel studs. These studs are then welded in place at the surface of the primary shielding, and smaller studs are attached to them in order to provide an anchor for the PE sheets.

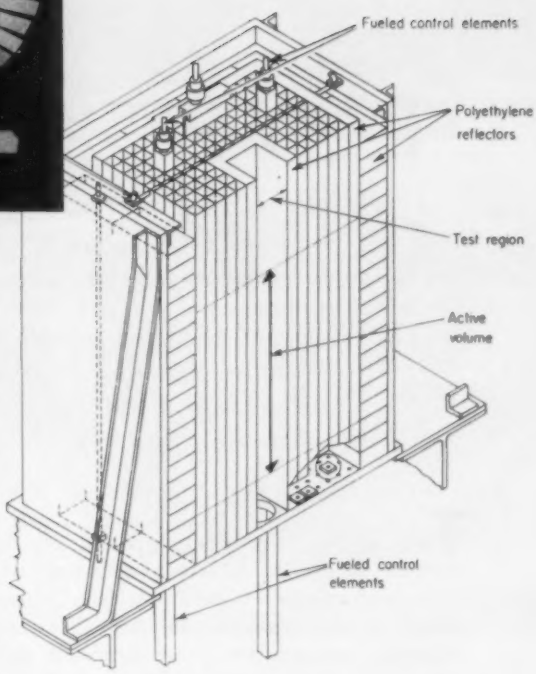
Since six or seven individual PE sheets are used to build up the necessary thickness of the neutron shield, small aluminum nails are used to hold them together during installation. A maximum of $1/16$ in. is generally provided between edges of the sheets to **(To page 201)**

Thickness required to attenuate neutron beam by factor of 10

Material	*Density*	*Shield thickness (in.)*
Water	1.0	8.8
Concrete	2.4	9.6
Concrete (high-density)	3.5	9.6
Iron	7.9	5.7
Lead	11.3	7.8
Polyethylene	0.93	8.0



Photos, Battelle Memorial Inst.



Another example of PE's neutron-taming ability may be found in the uranium-fueled reactor recently set up at Battelle Memorial Institute, a research center in Columbus, Ohio. PE blocks, 4 in. thick, are installed around the four sides of the reactor to slow down the high energy rate of neutrons and bounce them back into the reactor core. Other PE neutron reflectors, in strip form, are installed at top and bottom (right and left, photo above) of the fuel elements, which are housed in square aluminum cans. These reflectors are 12 in. long at the top of the fuel cans, 6 in. long at the bottom. PE strips are also used to sandwich the uranium metal strips in the fuel box (above, center). Their purpose is to slow down neutrons and thereby increase the probability that the neutrons will collide with uranium nuclei to sustain the chain reaction. The test area in the center of the reactor can be lined with PE to a thickness of 1 to 2 in. to further slow neutrons and concentrate them in test area. Cost of all the PE components in the reactor is about $3,000, their weight approximately 780 pounds.

Photo, Westinghouse

BLOCKS of low-density PE are installed as neutron shielding aboard *N. S. Savannah*. About 250,000 lb. of sheeting, bolted by small studs to layers of lead, are used in this vessel.

SLEEVE of PE film encases manipulator arm used to handle materials in "hot cell" experiments. Film protects arm from radioactive dusts. Gage of film is tapered from 10 mils at "shoulder," where greater strength is needed, to 5 mils at "wrist," where more flexibility is desired. Photo, U. S. Industrial Chemicals

By W. B. Royall* and R. W. Matlock**

Epoxy passes toughest test:

The success of the Courier 1-B satellite will be of more than passing interest for industrial users concerned with the performance of reinforced epoxies under conditions of extreme heat and cold, intense radiation, and high vacuum. This space vehicle, still in orbit more than a year after launch, relies heavily on glass-reinforced epoxy for its structure. Its continued presence in the sky makes the material a promising candidate for more earthbound applications where service environments are severe and critical

The satellite structure consists of an outer spherical shell of reinforced epoxy supported by an octahedron space frame of welded aluminum. To the frame are attached three honeycomb sandwich platforms on which electronic equipment is mounted. At the southern pole of the sphere, a molded epoxy flange plate anchors the satellite to the launching rocket.

Selection of epoxy resins was based on a number of factors: They not only provide the requisite adhesion to fibrous glass, honeycomb core, and metals, but they also contribute high strength, light weight, and rigidity even in cross sections as thin as 0.285 inch. And they do all this under conditions of outer space for periods of time which may run as long as several years.

How the shell is molded

The outer shell consists of two identical laminated hemispheres and serves three purposes: 1) a surface for attaching solar cell arrays totaling nearly 20,000 individual units; 2) a ground plane for various antennae mounted on the shell's equatorial metal band; and 3) an environment-protecting cover and insulating barrier for the equipment housed inside.

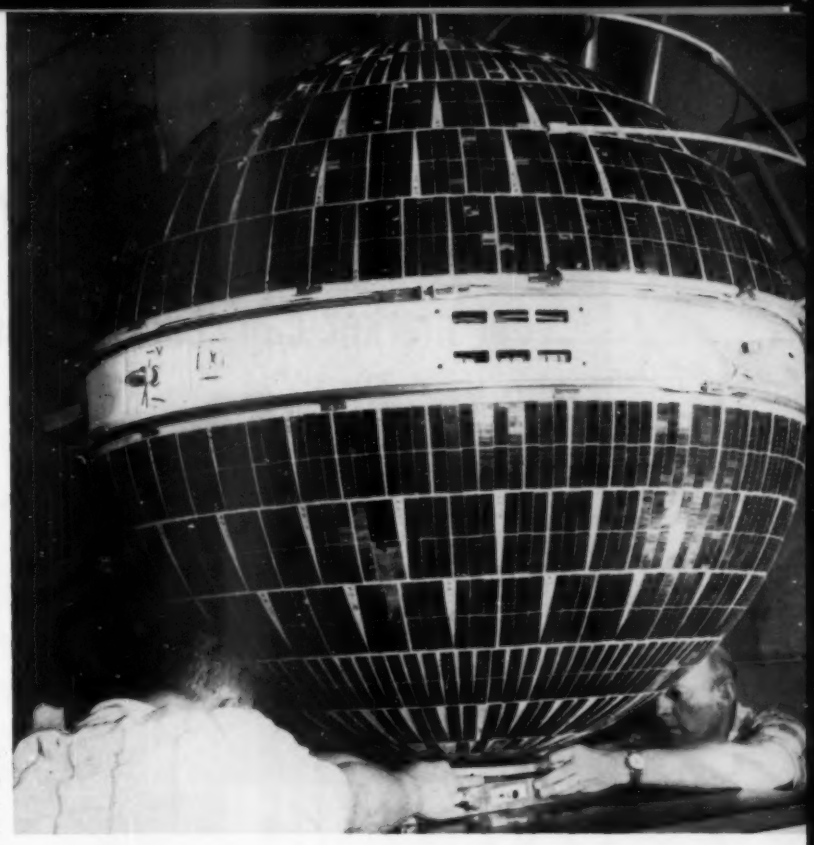
Both shell halves were produced in the same reinforced epoxy mold. The female mold was made by preparing a male plaster on a wooden plug. A gel coat was applied to the plaster and the epoxy resin and glass cloth were built up to the desired thickness. After the resin had cured, the mold was removed from the form and placed on steel supports.

In making the satellite shells, the female mold surface was first sprayed with a release agent, then brushed with a mixture of 100 parts epoxy resin and 14 parts m-phenylenediamine curing agent. This laminating system was used in all of the Courier's plastic structures. Titanium dioxide powder was added to the resin for the outer skin. The pigment gave a whitish reflective cast to the

OUTER SKIN of satellite begins to take shape as prewet glass cloth is smoothed against surface of epoxy mold. Additional resin was applied and assembly vacuum-bagged and oven-cured.

HONEYCOMB CORE is applied after second layer of glass-epoxy skin has been laid in mold. After vacuum-bagging and curing, third layer of glass-epoxy was laid down.

OUTER SPACE



COURIER satellite is composed of two hemispheres of glass-reinforced epoxy to which are bonded 20,000 solar power cells. Structure is being readied for vibration test.

outside surface of the hemisphere to help maintain the proper temperature environments inside the satellite for protection of the components.

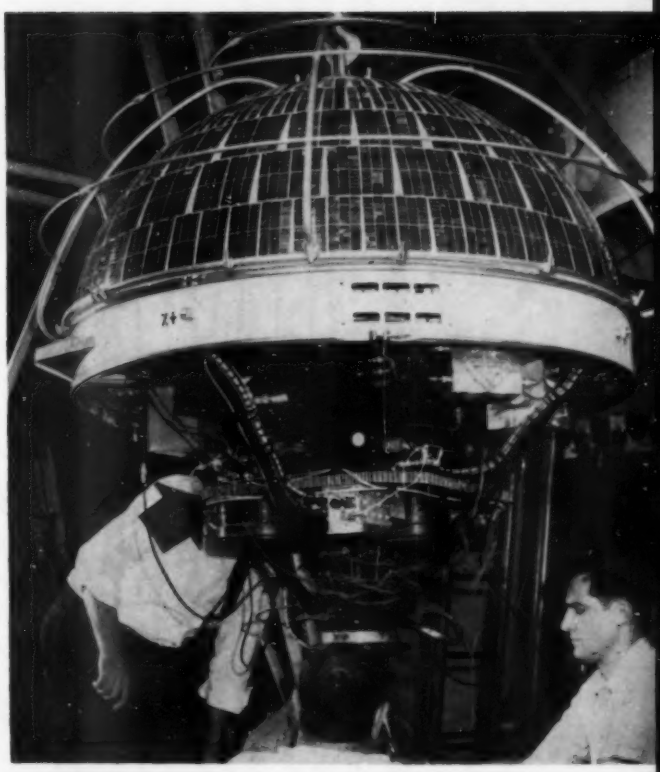
One sheet of glass cloth (style 181) was impregnated with the pigmented resin and draped in the mold without joints, overlaps, or splices in order to effect a single skin of continuous strength. With the wet cloth properly positioned, additional resin was applied to saturation to ensure a thoroughly void-free outer skin.

A bleeder spring was taped around the upper edge of the mold, and the assembly vacuum bagged, using a polyvinyl alcohol sheet. The layup then was oven-cured for 2 hr. at 300 F., the time and temperature used for all laminations.

Following cure of the outer skin, its inner surface was sanded. Aluminum was flame-sprayed to a thickness of 0.005-in. into the sanded surface. The metallic layer provided the required electrical conductivity between the two hemispheres and the solar cells.

The coated metal interior was covered with resin-preimpregnated glass cloth, the resin penetrating the porous aluminum film to the outer skin. A lightweight, phenolic-nylon honeycomb core, ¼ in. thick was fitted over the wet skin. This layup was vacuum-bagged and oven-cured.

The adhesive strength of the **(To page 205)**



HONEYCOMB sandwich panels (note arrow) with reinforced epoxy skins and phenolic-nylon cores are used as platforms for electronic equipment package of the Courier.

*Western Development Laboratories, Philco Corp., Palo Alto, Calif.
**Summit Industries Inc., Gardena, Calif.

Markets keep growing for injection-molded BAKELITE® high-density polyethylene

...your market can reap the same benefits as these

HOUSEWARES—These tumblers and cups, injection-molded by Fedco, stand up to any scalding dishwasher temperature, even boiling water and steam sterilization. BAKELITE high-density polyethylene helps make it possible. They're comfortable to handle because of an insulating air space between their double walls.

TOYS—Four-year-olds can dish out punishment—but this colorful sit-and-ride fire-truck by Eldon takes it with ease. Injection-molded of BAKELITE high-density polyethylene, it has excellent resistance to impact and abrasion.

APPLIANCES—When critical points of strain and wear are involved, appliance makers have turned to BAKELITE high-density polyethylene. This gusset for a major brand refrigerator is a case in point. Toughness plus rigidity—at different temperatures—are a specialized demand, but a job high-density polyethylene does well.

PACKAGING—Closures of BAKELITE high-density polyethylene offer even more than sales-winning color and gloss. They're tough, rigid, dimensionally stable—important to the package designer. Equally important, they're inert to an endless variety of contents. Molded by Gibson Associates, Inc.

CARS—Here is only one of many automobile components now specified in BAKELITE high-density polyethylene. The one-piece glove compartment for American Motors is a brand new departure in its field.

Which BAKELITE high-density polyethylene is right for you?

CHARACTERISTICS	HOMOPOLYMERS				COPOLYMERS	
					For toughness, stress-cracking resistance, flex life	
	DMD-6201	DMD-7004	DMD-7014	DMD-7080	DPD-7070	DMD-7062
Description	High Flow General Purpose	High Rigidity	7004 Equiv. With Improved Weathering	7004 Equiv. With Higher Flow	High Rigidity	Extra High Rigidity
Density, gm/cc	0.950	0.960	0.960	0.960	0.945	0.950
Melt Index, gm/10 min.	8.0	3.5	3.5	5.0	8.0	7.5
Secant Modulus psi (stiffness)	100,000	150,000	150,000	150,000	70,000	100,000
MECHANICAL						
Tensile Strength, psi	3,300	4,700	4,700	4,600	2,250	3,200
Ultimate Elongation, %	45	30	30	15	25	25
CHEMICAL						
Water Absorption, %	0.03	0.03	0.03	0.03	0.04	0.03

Looking for fresh avenues to bigger profits? Take a good, close look at what's happening in many markets now capitalizing on the outstanding benefits of injection-molded high-density polyethylenes.

Union Carbide Plastics, with a full line of 6 different BAKELITE high-density polyethylenes, gives you the widest one-source selection of performance characteristics in the industry (the chart to the left presents the highlights).

If you have a production or design problem, look to BAKELITE high-density polyethylenes for profitable answers. And don't forget that Union Carbide Plastics also markets the most complete line of low-, medium-, and high-density polyethylenes for blow-molding, too. For help, write Union Carbide Plastics Company, Division of Union Carbide Corporation, Dept. KM-87J, 270 Park Avenue, New York 17, New York.

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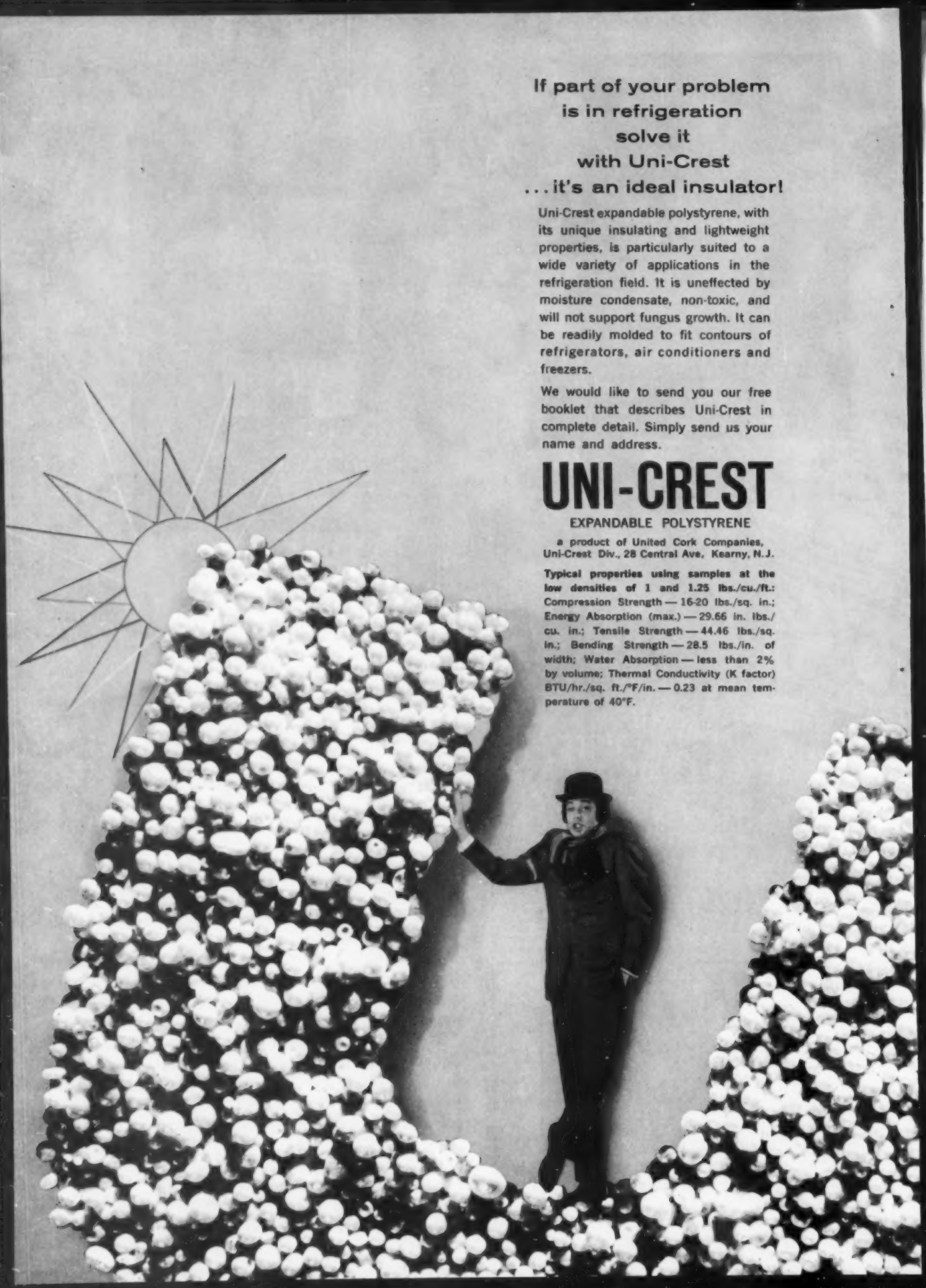

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George R. Smoluk, ENGINEERING EDITOR

PLASTICS ENGINEERING*

PROCESSING • FABRICATION • PRODUCT DESIGN • TOOL AND EQUIPMENT DESIGN

How to select a vacuum system for thermoforming

Detailed examples explain the sizing of reservoirs and pumps and the estimation of minimum cycle

By Philip F. Charles†

The vacuum system for thermoforming equipment should be seriously evaluated long before you must actually start forming 30,000 to 60,000 parts/hr. requiring a 5½-in.-deep draw or making liners for 9-cu.-ft. refrigerators. Your vacuum system is a major factor in both quality and rate of production. Speed of the forming cycle is limited by the capacity of the vacuum system. Sharpness of detail is determined by the maximum vacuum as well as by when and how rapidly this maximum vacuum is applied to the heated plastic sheet. Part shrinkage can also be varied considerably by the amount of vacuum and the length of time the vacuum is applied during the forming operation.

As parts are formed, the vacuum pump requires a certain amount of operating, or recovery time, after each cycle to re-evacuate the system. When there is insufficient recovery time, working pressure in the system will increase and sharpness of detail and quality will suffer. As a practical rule-of-thumb, the actual forming or cycle time should be not less than twice the recovery time.

Since the vacuum system has an important influence upon quality, thermoforming experts emphasize the importance of instantaneous application of maximum vacuum, rather than a gradual reduction in pressure over the entire cycle. The importance of rapid application of full vacuum becomes apparent when you consider the way the sheet cools in the mold.

The side next to the mold starts to harden upon contact. It drops below its heat-distortion point and hardens while the other side is still warm and pliable. As the mold-side hardens and shrinks, the warmer side flows to conform. As the warm side also shrinks upon further cooling, the mold side, already hardened, cannot flow to conform to this shrinkage. The end

*Reg. U. S. Pat. Off.

†Compressor Engineering Dept., Ingersoll-Rand Co., New York, N. Y.

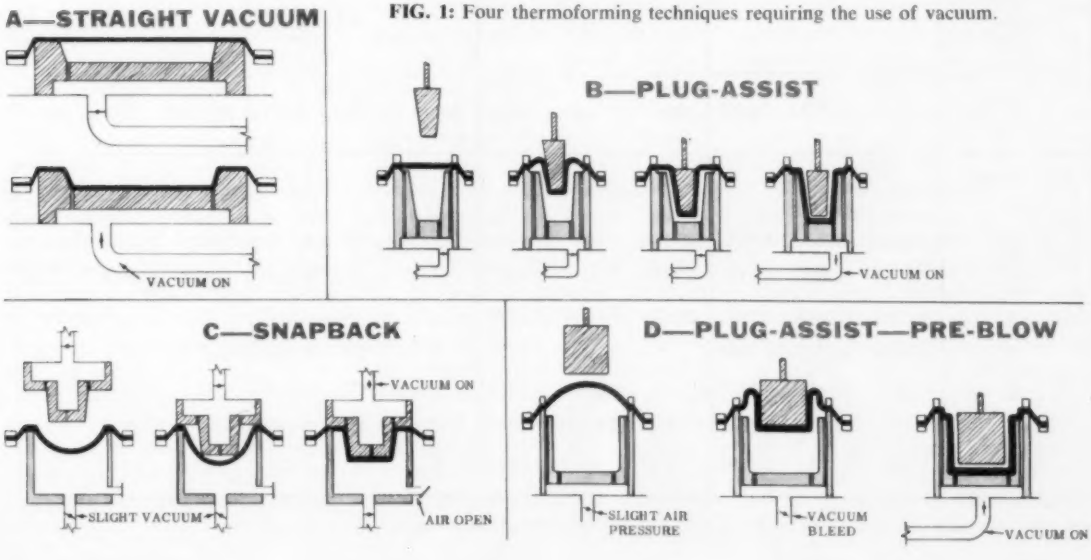

FIG. 1: Four thermoforming techniques requiring the use of vacuum.

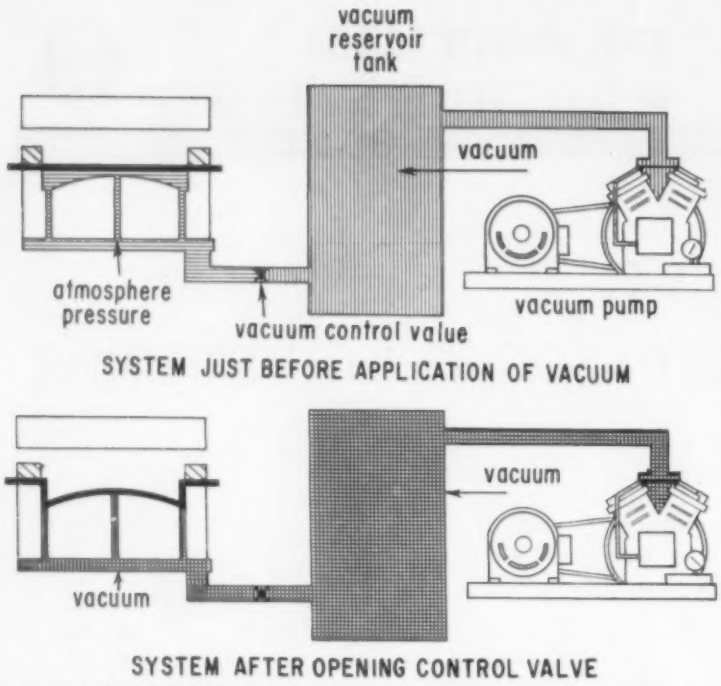

FIG. 2: Schematic showing use of reservoir which is used to smooth out pulsation in vacuum on short cycles and which allows the use of a smaller pump on long cycles. Example in text shows how to size reservoir tank.

result is an internally stressed condition; the mold side in compression and the warm side in tension.

These stresses can be substantially increased in a distinctly nonuniform pattern if high vacuum is not applied immediately when the hot sheet hits the cold mold. To avoid such stresses, the sheet should be formed and held tightly against the mold while the material is still as warm as possible after the initial application of heat.

The control of shrinkage is most important, especially in large pieces such as refrigerator door liners and food cabinet liners with integrally formed shelf supports, etc. Most of the shrinkage takes place by the time the formed part reaches room temperature. A substantial portion of this takes place before the part leaves the mold. Maximum shrinkage occurs in cavity-type molds (no male plug) where the only deterrent to shrinkage away from the walls is the vacuum held on the part during cooling. The maximum possible vacuum must be maintained to minimize shrinkage.

How much vacuum?

Manufacturers of plastics thermoforming equipment recommend a vacuum of at least 20 in. of mercury, or about 5 p.s.i.a., as the maximum working pressure. The vacuum system, that is, the vacuum pump, reservoir, and piping, should be designed to keep the system pressure from ever rising above the recommended 5 p.s.i.a.

To digress a moment, all discussions, calculations, and specifications for vacuum systems should be stated clearly and consistently in one form or another—we prefer vacuum-inches of mercury. Consistency and exact definition of terms avoids confusion resulting from someone loosely specifying the pressure required in a system as simply "20-inches;" this could

Table I: Pressure loss due to pipe friction in vacuum systems[a]

Absolute pressure / p.s.i.a.	7.4			5.0			2.5			1.0		
velocity[b] / ft./sec.	40	70	100	40	70	100	40	70	100	40	70	100
Pipe diameter / in.												
1	0.442	1.160	1.965	0.3288	0.788	1.375	0.1547	0.406	0.837	0.967	0.1965	0.641
2	0.1741	0.580	0.935	0.1160	0.3675	0.641	0.0774	0.1934	0.3675	0.0580	0.0982	0.1934
3	0.1160	0.2900	0.561	0.0774	0.1965	0.3675	C	0.1160	0.2127	C	0.0580	0.0982
5	0.0580	0.1547	0.3481	C	0.1160	0.2321	C	0.0580	0.1160	C	C	0.0580
8	C	0.0967	0.2127	C	0.0580	0.1354	C	C	0.0774	C	C	C
10	C	0.0774	0.1741	C	0.0491	0.0967	C	C	0.0491	C	C	C
12	C	0.580	0.1354	C	C	0.0580	C	C	C	C	C	C

[a] p.s.i. per 100 ft. of pipe. [b] Velocity (ft./sec.) = $\frac{\text{PD (cu. ft./sec.)}}{(60)\ (\text{pipe area, sq. ft.})}$. [c] Less than 0.0491.

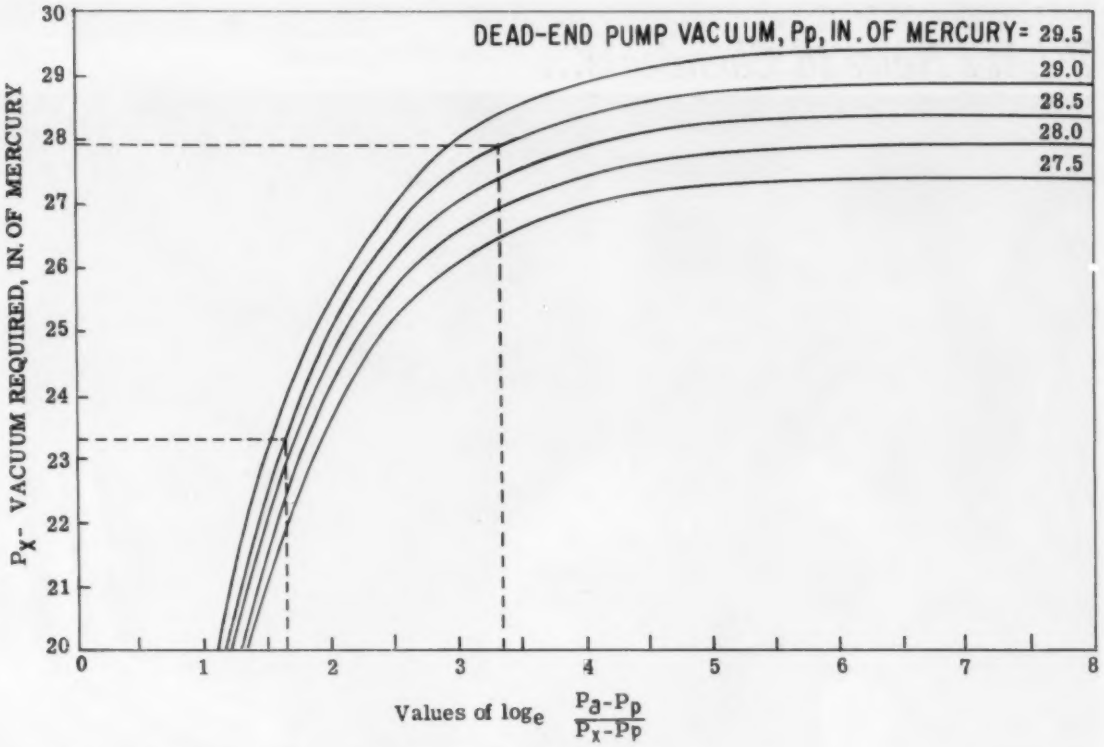

FIG. 3: Graph showing values of logarithmic quantity shown in Eq. 3, p. 211, for various values of vacuum desired, P_x, and dead-end pump vacuum, P_p, when the latter are expressed as vacuums in terms of inches of mercury.

mean either a vacuum of 20 in. of mercury which is about 4.9 p.s.i.a., or a pressure of 20 in. of mercury which is about 9.8 p.s.i.a. Conversions to other units of vacuum from inches-of-vacuum can be made by using the conversion factors boxed on p. 109.

Theoretically, the vacuum system capacity required (or total rate of consumption) equals consumption per cycle times the number of cycles per minute. The volume of vacuum required per cycle is equal to the volume of the mold, piping, and vacuum channels between the plastic sheet and the vacuum control valve, or between sheet and vacuum pump if no control valve is used. In all cases, pipe volume between the clamped sheet and the vacuum off-on control should be kept to a minimum in order to reduce the unnecessary waste of vacuum.

The forming technique used has an important bearing on the vacuum capacity required. When using straight vacuum forming (see Fig. 1A, p. 105) or plug-assist forming (Fig. 1B), the volume of the mold can be readily determined. This establishes the volume of air evacuated from the mold per cycle. However, when using snapback forming (Fig. 1C), or plug-assist pre-blow forming (Fig. 1D), the problem is more complex.

With snapback or pre-blow forming, the volume included in the drape of the material, in addition to the volume of the mold, must also be evacuated. This will vary with the amount of drape or blow. However, usual practice is to allow the drape or the bubble to contain approximately the same volume as the mold. Therefore, in drape forming the mold volume used in calculations should be doubled.

For pre-blow forming, allowance must be made for the 3- to 5-p.s.i.g. compressed air pressure admitted to the bubble mold and piping. Each cubic foot of the compressed air contains a substantially greater volume-amount of air than air measured at atmospheric pressure. To account for this increased amount of air to be evacuated, multiply the volume of the mold and system components by the ratio of the absolute pressure of the compressed air (17.7 or 19.7 p.s.i.a.) to atmospheric pressure (14.7 p.s.i.a.). In other words, for pre-blow forming at 3 p.s.i.g., take the volume of the mold, double this to allow for the volume of the pre-blow bubble, add to this the volume involved in the piping to both the compressed-air control and to the vacuum control. Multiply this total mold, bubble, and piping volume by the ratio previously established (17.7/14.7−1.2+). This represents the total volume of air at atmospheric pressure to be evacuated for each cycle.

Losses throughout the vacuum system must also be considered. There are two primary sources of vacuum loss—leakage and pipe friction. Pipe friction becomes most important in high-volume production of quality parts. As can be seen from Table I, p. 106, vacuum losses vary substantially with the velocity of air being exhausted through the system. These losses can be reduced by providing piping of adequate size so that velocities are reduced. For a specific example,

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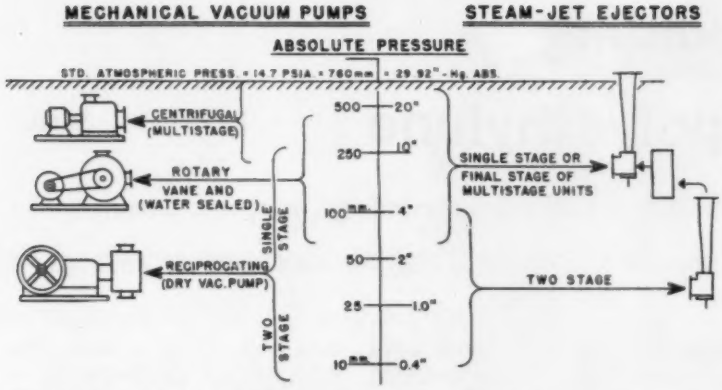

FIG. 4: Chart showing various vacuum producing devices and the range of vacuums each is capable of producing. Steam ejectors are practicable only when a large volume of low-cost steam pressure is available.

at an air flow rate of 70 ft./sec., 1.16 p.s.i. of the pump's working pressure is lost for each 100 ft. of 1-in. pipe in the system.

Extra pumping capacity must also be added to make up for leakage. In addition, it may be extremely difficult to hold maximum vacuum on a system that does not meet the requirements of a commercially tight system. A reasonable amount of maintenance should keep leakage under control, but vacuum pump manufacturers still recommend adding 20 to 30% to calculated piston displacement required, depending on leakage conditions. System volume includes the capacity of all the piping and of any tank or receiver between the vacuum pump and the thermoforming machines.

The final question in laying out or specifying a system for thermoforming is, naturally, "How large a vacuum pump do I need?" There are several factors to consider in determining how large a pump you will need: consumption per cycle including all losses, cycle time, and recovery capacity of the system including the reservoir.

Sizing the reservoir

Vacuum can be "stored" the same as compressed air and you should always use a tank or reservoir to smooth out consumption peaks and valleys. If you have a very short cycle time, the reservoir will be used merely to smooth out pulsations. With longer cycles, large storage capacity in the system and reservoir will permit reducing original equipment cost by allowing the installation of a smaller vacuum pump.

When the mold is suddenly opened to the larger tank, the pressures are equalized almost instantaneously. Then, when the valve in the connecting pipe is closed, the pump will continue to evacuate the reservoir to bring it down to minimum absolute pressure so as to be in readiness for the next draw.

The size of the reservoir necessary to develop a desired working pressure in the mold may be determined by this relationship:

$$V_m P_a + V_s P_a = P_w (V_m + V_s) \quad \text{Eq. 1}$$

where:

V_m = mold volume plus piping to the vacuum control valve, cu. ft.;

V_s = volume of the vacuum system between control valve and vacuum pump, including the reservoir, cu. ft.;

P_a = initial air pressure in the mold; either atmospheric (14.7 p.s.i.a.) or higher by the amount **(To page 211)**

Table II: Vacuum pump ratings

Size of vacuum pump	*Piston displ. 1-stage*	*Piston displ. 2-stage*	*Pump speed*	*Power of motor required*	*1-stage Size of inlet pipe*	*1-stage Size of discharge pipe*
	cu.ft./min.		*r.p.m.*	*h.p.*	*in.*	*in.*
3 by 2¾	9.0	——	800	¾	¾	¾
3 & 3 by 2¾	18.0	9.0	800	1	1	1
4 & 4 by 2¾*	32.0	16.0	800	2	1¼	1¼
5 & 5 by 3½	60.0	30.0	750	3 to 5	1½	1½
5½ & 5½ by 4	99.0	49.5	900	5	2	2
5½ & 5½ & 5½ by 4	149.0	99.0	900	7½	2	2

*4 & 4 by 2¾ means the unit has two cylinders with 4-in. diameter bores and a 2¾-in. stroke.

CONVERSIONS

Units of absolute pressure:

Standard atmospheric pressure = 29.92 in. of mercury
760.0 mm. of mercury
14.7 p.s.i.a.
1.0 atmosphere

To convert p.s.i.a. to: in. of mercury multiply by: 2.036
mm. of mercury 51.715
atmospheres 0.068

Units of vacuum:

All absolute pressure units below standard atmospheric pressure are also units of vacuum.

Vacuums in in. of mercury = Barometric pressure (in. of mercury)* minus absolute pressure of the system (in. of merucry)

To convert p.s.i.a. to in. of vacuum, convert p.s.i.a. to in. of mercury pressure and subtract from 29.92 in. of mercury.

*Barometric pressure usually assumed to be standard atmospheric pressure or 29.92 in. of mercury.

A guide to molding high-density polyethylene

By Roger B. Staub*

A summary of the effects of molding conditions on shrinkage, warpage, dimensional stability, dry coloring, and the physical properties of high-density polyethylenes

A wide variety of high-density polyethylene (PE) consumer items is injection molded. Sizes range from small gears to large parts for water softeners. Shapes range from intricate doilies to simple containers. Naturally, each item has its own product quality standards.

Although quality standards vary from item to item, the physical properties of the molded plastic which define product quality are common to all items. This article recommends optimum processing conditions for certain molded physical properties such as impact strength and surface appearance. Once the important properties defining quality of a desired molded item have been specified, the molder can apply this information to maximize product quality.

Most of the work was done with a polyethylene (DMD-7000)[1] having a melt index of 5 and a density of 0.96 g./c.c. in the molds and machines shown with the molding variables and the ranges studied in the box on p. 113.

*Chemical Engineer, Development Dept., Union Carbide Plastics Co., Bound Brook, N. J.

[1]A product of Union Carbide Plastics Co., as are other resins mentioned herein.

Mold shrinkage

Mold shrinkage is the difference between the dimensions of the mold cavity and those of the final molded article. Mold shrinkage data is required to design molds properly as well as to control piece dimensions during molding. Mold shrinkage was studied in the 7.5- by 9- by 0.075-in. plaque under the molding conditions outlined.

Two factors control the shrinkage of injection-molded high-density PE; 1) the change in volume during solidification and cooling of the melt to the solid state and 2) the variation in shrinkage parallel to and across the direction of flow. Volume changes in high-density polyethylene are shown in the relative volume[2] vs. temperature curve shown in Fig. 1, below. The same data for low-density PE is shown for comparison. Volume decreases considerably in cooling from a typical molding temperature of 400° F. to room temperature. With reference to the second factor, anisotropic shrinkage induced by flow in these experiments indicated that shrinkage parallel to the direction of flow averaged 9 mils/in. higher than that across the flow direction. Fig. 2, below, shows how this shrinkage imbalance caused a curvature in the bottom edge of the molded plaque.

[2]Relative volume is the ratio of the volume of a material at a given temperature to its volume at room temperature.

Shrinkage measurements were taken at the positions indicated in Fig. 2. Over a broad range of molding conditions, shrinkage ranged from 22.1 to 40.2 mils/in. in the flow direction and from 13.4 to 33.1 mils/in. across the flow. Average values were 31.3 and 22.5 mils/in., respectively.

By varying molding conditions it is found that shrinkage is decreased by: 1) decreasing material tempera-

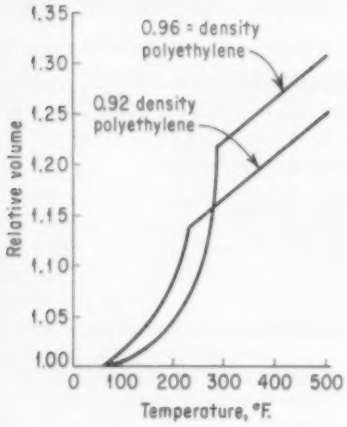

FIG. 1: Relative volume of two typical polyethylenes; one is high-density natural resin, while the other is conventional material.

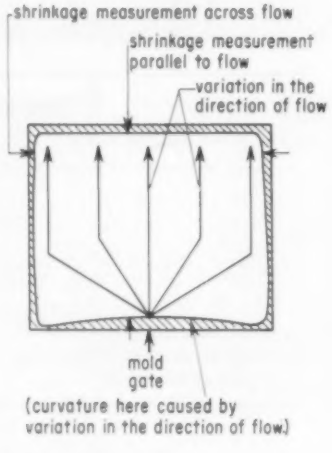
shrinkage measurement across flow
shrinkage measurement parallel to flow
variation in the direction of flow
mold gate
(curvature here caused by variation in the direction of flow.)

FIG. 2: Schematic of plaque mold showing how anisotropic shrinkage of material causes distortion and dimensional changes in part.

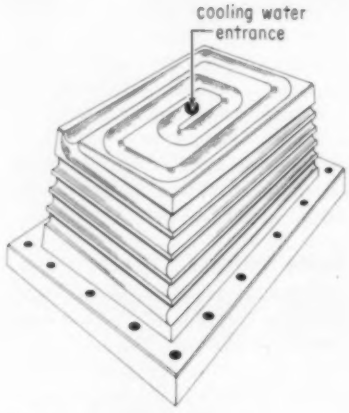

FIG. 3: Dishpan mold core component showing recommended coring pattern. Coldest water enters mold coring under the gate area.

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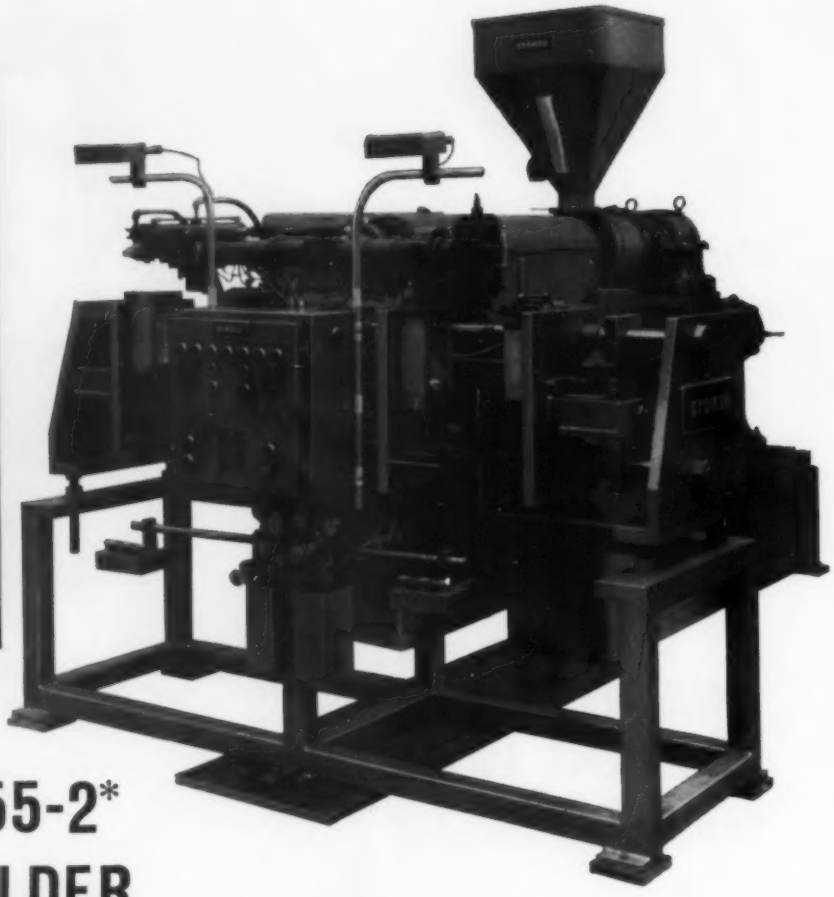

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ture, 2) decreasing mold temperature, 3) increasing plunger forward time, and 4) decreasing fill speed. Gate size and feed condition had no significant effect on shrinkage.

These results can be explained in terms of the relative volume curve of Fig. 1. Decreasing material temperature, decreasing mold temperature, and decreasing fill speed all tend to reduce the average material temperature in the filled mold. This, in turn, reduces the relative volume of the melt and the resulting shrinkage of the material in the mold. Increased plunger forward time decreases shrinkage by packing additional material into the mold to compensate for the thermal contraction after the mold is filled.

In general, to minimize mold shrinkage, one should mold under conditions of low material temperature, low mold temperature, long plunger forward time, as well as slow fill speed.

Warpage

Resistance to warping is important to the functionality as well as to the appearance of molded parts. Design details, such as ridges and offsets in flat sections, ribbed wall sections, and raised areas opposite the gate, help minimize warpage by increasing part rigidity and permitting stress relief. However, a degree of warpage control can also be obtained by selecting proper molding conditions. Warpage control was studied in three different molded items: the center-edge-gated plaque, the center-gated disk, and the center-gated dishpan.

In the plaque, the only variable which had a consistent effect on warpage was plunger forward time. Decreasing forward time decreased the warpage. Other variables—material temperature, mold temperature, fill speed, feed condition, and gate size—failed to have any consistent influence on warpage. The major factor contributing to warpage in this plaque was mold design. One problem was the variation in shrinkage caused by the different directions of flow throughout the molded plaque. Another problem was the non-uniform temperature of the mold surface, which caused additional shrinkage variation throughout the plaque because of non-uniform cooling rates.

In the 10-in. disk mold, molding variables exerted a more pronounced influence in warpage control. Complete data are shown in Table I, p. 116. Warpage was decreased by: 1) increasing fill speed, 2) decreasing plunger forward time, 3) using starved feed, and 4) decreasing material temperature. Cycle time and mold temperature had only minor effects.

Temperature across the mold cavity was quite non-uniform, and this undoubtedly contributed to the warpage. However, it appears that the level of **(To page 116)**

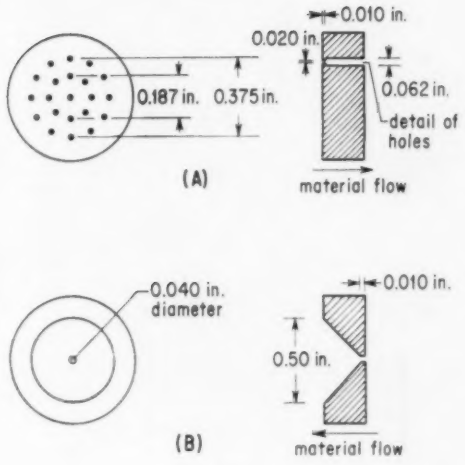

FIG. 4: Two types of dry coloring dispersion disks used with high-density polyethylene: (A) multihole breaker plate; (B) Venturi plate. Recommended dispersions are shown.

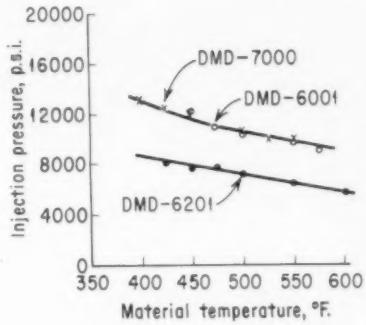

FIG. 5: Relationship between injection pressure required to fill and material temperature in a 10-in. disk mold for three different melt index high-density polyethylene resins.

Conditions of study

Molds and molding machines used

Mold	*Machine*
Center-edge-gated plaque (7.5 by 9 by 0.075 in.)	12 oz. Lester
Center-gated disk (10 in. (dia.) by 0.070 in.)	8 oz. Reed-Prentice
Rectangular dishpan (7 by 9 by 5 in. by 0.080 in.)	8 to 10 oz. IMPCO
Tumbler (6 oz.)	3 oz. Moslo

Molding variables studied

Variable	*Range-studied*
Material temperature	350 to 550° F.
Mold temperature	110 to 175° F.
Plunger forward time	10 to 40 sec.
Pressure (fill speed)	Minimum pressure to fill to 23,000 p.s.i.
Feed conditions	One-in. cushion and starved feed
Gate size[a]	0.040- by 0.230- by 0.020-in. tab gate to full round runner

[a]Plaque only.

In the dramatic torture test shown here, identical containers were blow-molded from Ameripol high-density polyethylene . . . and from another high-density material. The Ameripol bottle and the control bottle were then subjected to an increasing head of hydraulic pressure. In hundreds of test runs, the Ameripol bottle outlasted its opponent every time. When the control bottle ruptured, the Ameripol bottle was still pressure-tight. Then hydraulic pressure was again applied to the Ameripol bottle until it failed . . . at values ranging from 20% to 50% above the control bottle. This extra strength and durability of Ameripol high-density polyethylene can help you produce better quality containers and other blow-molded products at no extra cost. And Ameripol has one other outstanding advantage—it is easily processed on conventional equipment. For strong, beautiful blow-molded products check Ameripol. Write for Ameripol Technical Data file for complete physical properties and specifications. And, remember—Goodrich-Gulf Technical Service can help you with application.

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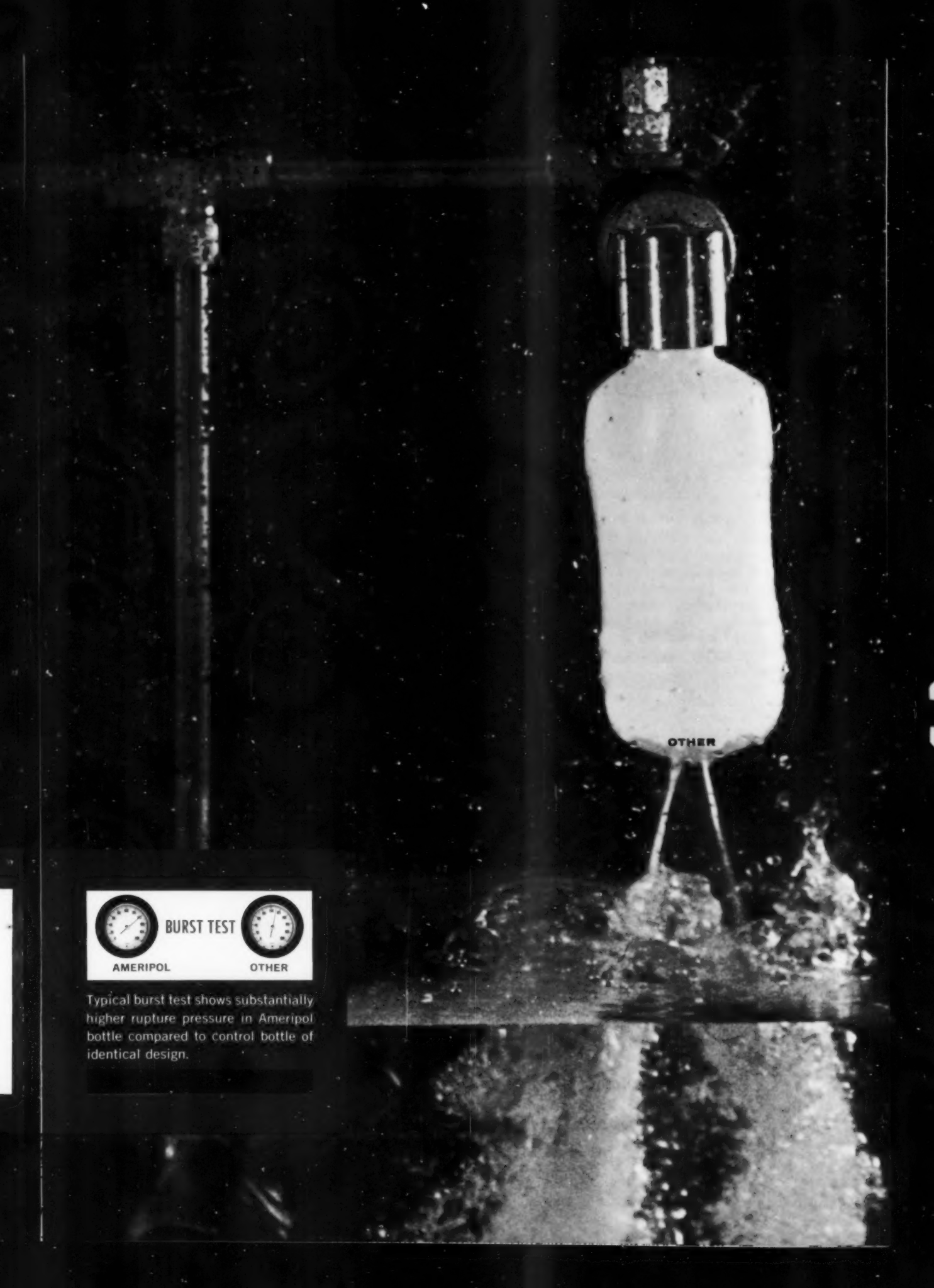

Typical burst test shows substantially higher rupture pressure in Ameripol bottle compared to control bottle of identical design.

Table I: Effect of molding variables on warpage and dimensional stability of high-density PE[a]

Material temp. °F.	*Mold temp.* °F.	*Fill speed*	*Plunger forward time* sec.	*Feed condition*	*Overall cycle time* sec.	*Warp height immediately after molding* in.	*Warp height several days later* in.	*Change in warp*
420	120	Max.	6	Starved	30	0.53	0.71	0.18
420	120	Max.	6	Starved	60	0.53	0.67	0.18
420	120	Max.	30	Starved	60	0.63	0.88	0.25
420	120	Min.	9	Starved	60	0.77	1.00	0.23
420	120	Min.	9	Cushion	60	0.98	1.15	0.17
420	160	Max.	6	Starved	30	0.56	0.78	0.22
420	160	Max.	6	Starved	60	0.50	0.66	0.16
420	160	Max.	30	Starved	60	0.67	0.85	0.18
510	120	Max.	6	Starved	60	0.72	0.78	0.06
510	120	Max.	30	Starved	60	0.89	1.02	0.13
510	160	Max.	6	Starved	60	0.60	0.74	0.14

[a]All samples made using 5-melt-index, 0.96 g./c.c.-density polyethylene in a 10-in.-diameter disk mold, 0.070 in. thick on an 8-oz. Reed-Prentice machine.

molded-in stress was the major cause of warpage. This conclusion is indicated by a consideration of the molding variables which affected warping of the disk. Increasing fill speed, decreasing plunger forward time, and molding with a starved feed all reduce molded-in stress, and in turn, warpage.

In the dishpan, warpage was reduced by: 1) decreasing material temperature, 2) increasing plunger forward time, and 3) increasing fill speed. Note that the effect of plunger forward time on warpage is reversed over what was obtained in the other molds. It appears that in the dishpan the major factor governing warpage is the over-all shrinkage rather than the variation in shrinkage throughout the piece and molded-in stress. Thus, the factors which tend to reduce shrinkage—decreasing material temperature and increasing plunger forward time—also reduce warpage.

Undistorted dishpans were obtained by molding at low (400° F.) material temperatures, long plunger forward times, and fast fill speed. There were two factors, inherent in the mold design, which aided molding flat bottom dishpans. These were the support from the side walls and the excellent coring of the mold which gave uniform mold temperature. The coring of this mold, which is the type recommended for high-density PE, has a spiral configuration (see Fig. 3, p. 110). With this type of coring the coldest water is circulated at the normally hot gate area of the mold. In this manner, the temperature of the mold surface is kept quite uniform.

In summary, three major factors appear to contribute to warpage: 1) over-all part shrinkage; 2) variations in shrinkage throughout the molded part (perhaps caused by flow effects or by non-uniform cooling, and 3) molded-in stress.

Probably the best method to minimize warpage is through part design. However, adjustments of molding conditions can also be used to minimize these problems.

Dimensional stability

The problem of dimensional stability was studied in the 10-in. disk mold to determine the influence of molding conditions. The procedure was simply to measure warp height after molding and again several days later. Complete data are shown in Table I.

Dimensional stability, or change in warpage, was improved by: 1) increasing material temperature, 2) decreasing mold temperature, 3) decreasing plunger forward time, 4) increasing fill speed, 5) molding with starved feed, and 6) increasing cycle time.

It appears there are two mechanisms by which dimensional change after molding occurs. One is through further crystallization of the material, which causes additional shrinkage. The other is the relief of molded-in stress, which causes additional distortion. One would expect that the colder the piece is removed from the mold, the less chance for further crystallization and shrinkage. This is substantiated by the effects of decreased mold temperature and increased cycle time, both of which tend to reduce the ejection temperature of the piece. The influence of molded-in stress is seen in the effects of increasing material temperature, decreasing plunger forward time, increasing fill speed, and use of starved feed, all of which tend to minimize molded-in stress.

Note in Table I that the maximum change in warpage was 0.25 in., and minimum, 0.06 inch. The minimum change occurred when molding at high material temperature, low mold temperature, low plunger forward time, starved feed, fast fill speed, and long over-all cycle. These conditions appear to considerably minimize dimensional stability problems.

Impact strength

The inherent impact strength of high-density PE is quite good. However, there are cases in which part design and molding conditions are such that impact strength may

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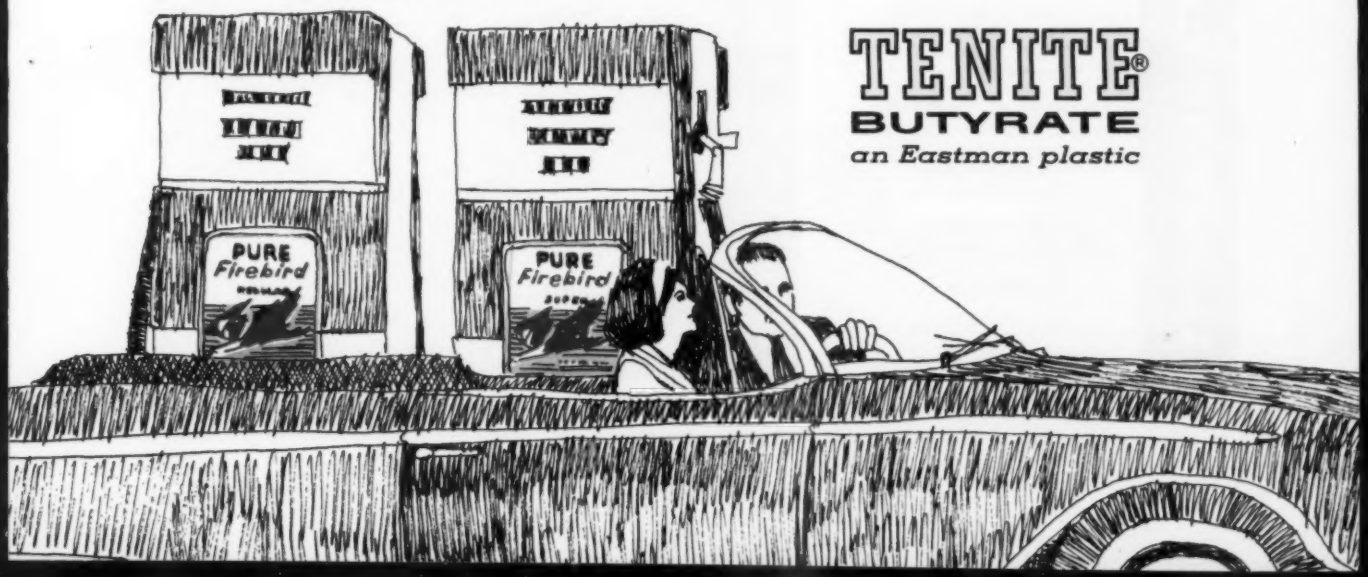

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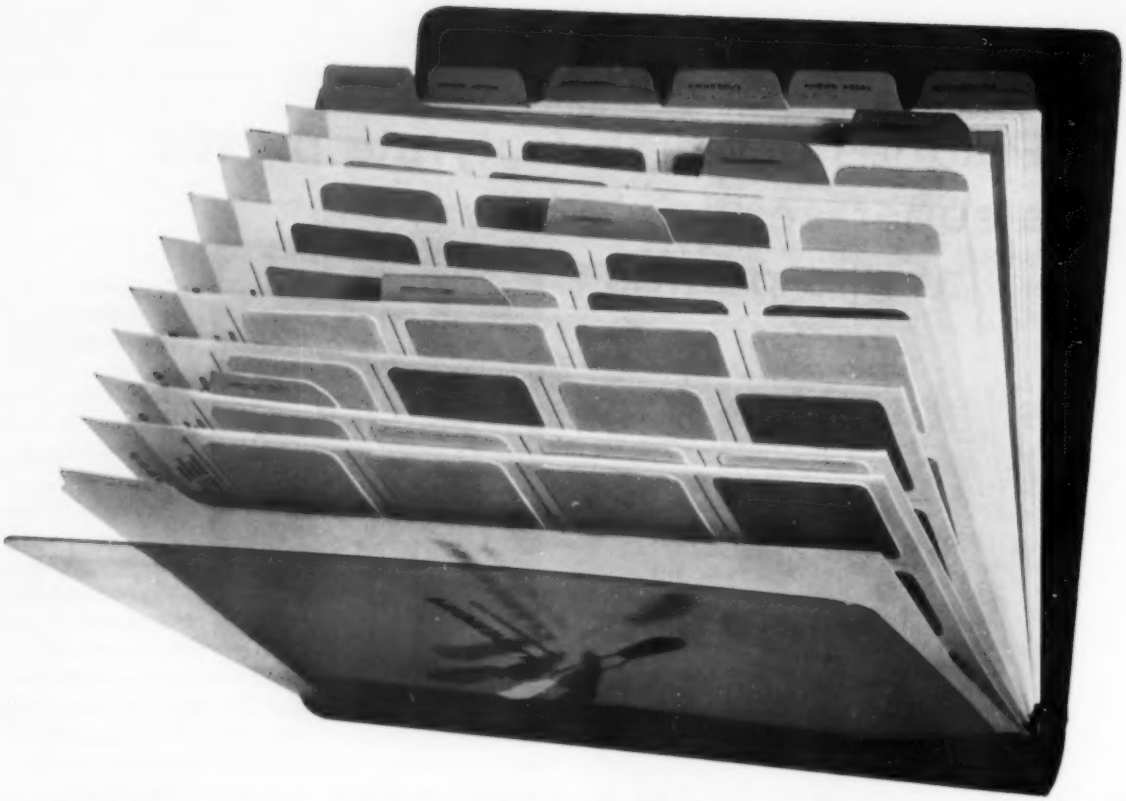

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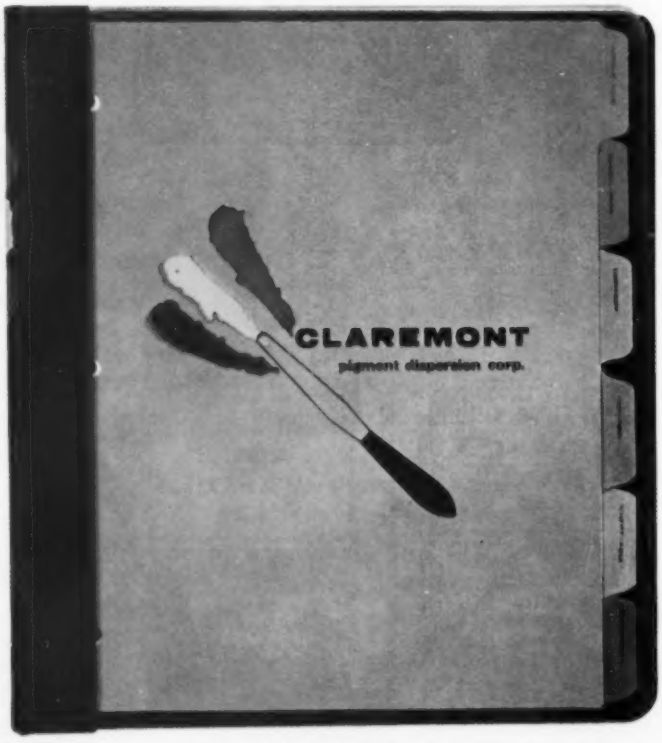

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be impaired. Thus, the plaque and dishpan molds were studied to determine optimum molding conditions regarding impact strength.

Test specimens were cut from these moldings in areas close to and away from the gate. The latter specimens were taken from the sides of the dishpans and 6 in. from the gate on the plaques. Tensile impact tests were used to determine impact strength.

In both articles, impact strength was greater away from the gate, usually by a factor of three. Generally, molding conditions had no significant effect on impact strength away from the gate. However, they had a marked influence on impact strength in the gate area.

In the dishpan, the only variable which had a major influence on impact strength was fill speed. Table II, right, shows that at slow fill speed the impact strength in the gate area was only 7.7 ft.-lb./cu. in. compared to 28.7 ft.-lb./cu. in. at fast fill speed. Even the impact strength in the side of the dishpan, which was normally not influenced by molding conditions, was markedly reduced at low fill speed. Variations in material temperature and plunger forward time had no significant effect on impact strength. Increasing mold temperature shows a trend toward increasing impact strength. However, the magnitude of the change in impact strength is much smaller than that resulting from variations in fill speed.

In most cases, best impact strength is obtained by molding at intermediate-to-high material temperature (450 to 500° F.), low mold temperature (110 to 130° F.), short plunger forward time, and fast fill speed.

Stress-cracking resistance

"Stress-cracking" is the term given to the rupture of polyethylene when it is exposed to detergents, solvents, and some other polar materials. The rupture usually occurs in the gate or sprue area, which is the weakest area of the piece. It can occur spontaneously, simply from the combined action of molded-in stress and solvent, or it can be accelerated by applying an external stress.

Stress-cracking resistance is important in many items molded of high-density PE, such as housewares, food containers, and other parts which may be exposed to stress-cracking agents.

There are three major factors (excluding intrinsic material variables) which influence stress cracking resistance and which are governed by molding conditions. These factors are crystallinity, molded-in stress, and molecular orientation. Generally, decreasing crystallinity, decreasing molded-in stress, and decreasing the degree of molecular orientation improve stress-cracking resistance.

Crystallinity is related to the ma-

Table II: Effect of molding variables on tensile impact tests strength of specimens cut from dishpans

Molding variables				Tensile impact strength ft.-lb./in.²	
Material temp. °F.	Mold temp. °F.	Plunger forward time sec.	Fill speed	Gate area	Side of dishpan
422	140	10	Maximum	26.7	63.5
470	140	10	Maximum	27.5	65.9
527	140	10	Maximum	25.1	73.9
460	118	10	Maximum	23.9	72.8
460	135	10	Maximum	24.3	79.6
460	150	10	Maximum	28.7	74.0
460	175	10	Maximum	17.8	72.8
460	140	10	Maximum	36.5	—
460	140	20	Maximum	39.2	—
460	140	Minimum (10 sec. max.)	Maximum	7.7	50.0
460	140	Minimum	Maximum	28.7	74.0

Table III: Effect of mold temperature on density and stress-cracking resistance (material temperature 460° F.)

Mold temperature °F.	Density g./c.c.	Stress-cracking[a] % failure after 24 hr.
118	0.9564	30
135	0.9577	60
150	0.9592	80
175	0.9610	100

[a]Dishpan test: ½-in. (dia.) ball, 30 ml. Trend/gal. water; tested on the gate area.

Table IV: Effect of material temperature and plunger forward time on stress cracking (mold temperature 150° F.)

Material temp. °F.	Plunger forward sec.	Stress-cracking resistance[a] days for 50% failures
350	15	21
350	40	5
500	15	*No failures*
500	40	3

[a]Tumblers, tested unstressed in a detergent bath at 50° C.

Table V: Color dispersion ratings and pressures for various dispersion aids[a]

Dispersion aid	*Color dispersion*[b]	*Minimum pressure to fill*
		p.s.i.
None	1.0	13,000
Multi-hole breaker plate	4.5	15,800
Venturi plate	5.0	18,300

[a]Using 5-melt-index, 0.96 g./c.c.-density polyethylene to mold dishpan. [b]Rating of 5 is excellent, 1 is poor.

terial's cooling rate in the mold; the faster the cooling, the lower the crystallinity. Crystallinity can readily be measured by measuring part density; the lower the density, the lower the crystallinity. A laboratory study of the density in the gate area of molded dishpans indicated that mold temperature was the greatest influence on density. Typical data for this study are shown in Table III, p. 119.

Increasing mold temperature increases density from 0.9564 g./c.c. at 118° F. to 0.9610 g./c.c. at 175° F. This is apparently caused by the slower cooling rate at the higher mold temperature.

Stress-cracking resistance was measured by filling the dishpans with a detergent solution and placing them on a 0.5-in. steel ball positioned directly under the gate. These data are also shown in Table III. Note the general correlation between mold temperature, density, and stress-cracking resistance. Increasing mold temperature increases density and decreases stress-cracking resistance.

The variables which most influence molded-in stress and frozen-in molecular orientation are material temperature, plunger forward time, and fill speed. As a result, these variables also have a marked effect on stress-cracking resistance. To minimize molded-in stress and orientation, the mold should be filled quickly with material at a high temperature and with a low level of mold packing. Theoretically, these conditions would also optimize stress-cracking resistance.

The influence of these conditions on stress-cracking has been studied with a variety of tests and molded items. In most cases, results verify that stress-cracking is improved by increasing material temperature, decreasing plunger forward time, and increasing fill speed. Typical results selected from the various data are shown in Table IV, p. 119. In this case tumblers were tested, under no external stress, in a 50° C. detergent bath. Note the superior stress-cracking resistance at high material temperatures and low plunger forward times.

High material temperature, short plunger dwell, and fast filling will generally improve crack resistance; however, exceptions will occur. For example, it has been observed in a particular type of test, best crack resistance was obtained at low material temperatures, which contradicts the general rule. However, these results were found to be peculiar to this particular test and were an exception rather than the general rule.

Proper mold design can also reduce stress-cracking. A well-designed cooling system (as shown in Fig. 3, p. 110) will help by promoting uniform mold temperature. This reduces thermal stresses introduced by non-uniform cooling rates. A special cooling system to keep the gate area of the mold cool will also help. This minimizes the degree of crystallinity. Design of a raised section, or "button," in the bottom of the piece opposite the gate strengthens this part of the piece and thus will also improve crack resistance.

The effect of inherent material variables on stress-cracking resistance is well established. Generally, the two most important ones are density and molecular weight, or melt index. Density is related to crystallinity, as was discussed previously, and as a rule increasing density decreases stress-crack resistance. Increasing molecular weight, or decreasing melt index, improves stress-crack resistance. In most cases, material variables have a considerably greater influence on stress-cracking resistance than do molding conditions.

Surface appearance

Molded high-density PE articles exhibit two types of surfaces. One is a glossy surface of very high lustre which accurately reproduces the mold finish. The other is a surface marred by flow or "chatter" marks which form across the direction of flow. Chatter marks are believed to be caused by a melt fracture phenomenon (as indicated by waviness in the flow) which causes the plastic material to bounce across the mold cavity.

The molding variable which influences surface appearance most is material temperature. Increasing material temperature, when chatter marks were present, improved appearance. However, once chatter marks disappeared, further material temperature increases did not add to surface appearance. When 5-melt-index, 0.96-density PE was used, chatter marks disappeared at a melt temperature of about 400° F. If lower-melt-index polyethylene material is used, this "chatter mark-free," or minimum gloss, temperature occurs at a much higher value.

Mold temperature, plunger forward time, fill speed, feed conditions, and gate size had little or no effect on surface appearance. However, in actual plant practice, it has been found that in some cases increasing mold temperature improves surface appearance. This is particularly true when molding is done near the minimum gloss temperature. Thus, to improve surface appearance one should increase material temperature or mold temperature, or both.

Dry coloring

In dry coloring, occasions arise where the mixing during molding is inadequate and poor color dispersion results. The use of special processing conditions to improve color dispersion is then required. These conditions were studied in the following experiments.

Dry coloring was done by tumbling 1% red pigment with natural resin for ½ hour. **(To page 123)**

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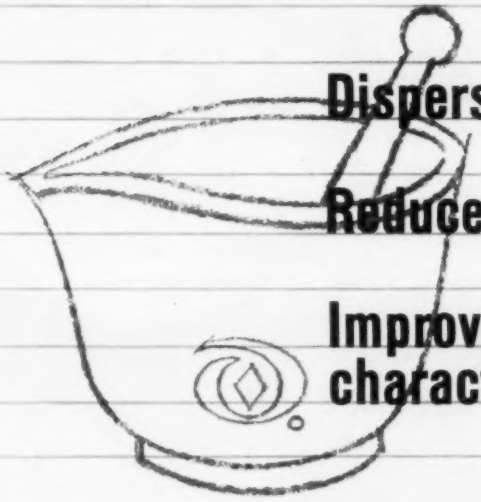

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Table VI: Summary of influence of molding variables on piece quality

Property	*Best molding conditions*
Minimum mold shrinkage	Low material temperature, low mold temperature, long plunger forward time, slow fill speed.
Minimum warpage	Low material temperature, fast fill speed, minimum plunger forward time (depends on mold design—in some cases should use long plunger forward time), uniform mold temperature.
Best dimensional stability	High material temperature, low mold temperature, minimum plunger forward time, starved feed, fast fill speed
Highest impact strength	Intermediate-to-high material temperature, low mold temperature, minimum plunger forward time, fast fill speed.
Best stress-crack resistance	High material temperature, low mold temperature, minimum plunger forward time, fast fill speed.
Best surface appearance	Intermediate to high material temperature, high mold temperature.
Best dry colorability	Molding variables do not effect; use breaker plate.
Best overall quality	Intermediate material temperature (400 to 450° F.), low mold temperature (110 to 130° F.) minimum plunger forward time; fast fill speed.

The dry-colored material was then molded over a broad range of conditions in the plaque mold mounted in the 12 oz. Lester injection molding machine.

None of the molding variables, not even the use of the restricted gate, significantly improved dry coloring. The ineffectiveness of the restricted gate was surprising. It appears that the tab gate (0.040- by 0.230 by 0.020 in.) used in this study simply does not provide sufficient additional mixing to improve dry coloring. Our observation is that a more restricted gate should have a more pronounced effect on dry coloring.

The best method for improving dry coloring is the use of a dispersion aid positioned in the nozzle of the injection machine. Two dispersion aids commonly used for PE are shown in Fig. 4, p. 113. The multi-hole breaker plate (Fig. 4A) was first used for coloring high-melt-index, low-density material. However, this breaker plate can also be used for high-density polyethylene material. The Venturi plate (Fig. 4B) is a single-hole component that was designed and developed by the Ferro Corporation.

Both mixing devices can improve color dispersion to the point where it is nearly equivalent to compounded color. However, they require an increased molding pressure, as shown by the data in Table V, p. 120.

The data were obtained by molding 5-melt-index, 0.96-density material (dry tumbled with 1% red pigment) into dishpans. The Venturi plate had a single hole with a diameter of 40 mils and a land length of 10 mils. The breaker plate consisted of 21 holes, each of which was 20 mils in diameter and with 10-mil land lengths.

The two most important design details in these dispersion aids are the hole diameter and land length. Color dispersion improves as hole diameter decreases; however, at the same time, molding pressure requirements increase. Thus, in selecting the final hole diameter, color dispersion must be balanced against the pressure requirements. Land length should be retained at the absolute minimum. This is normally 10 mils.

Resin flow properties

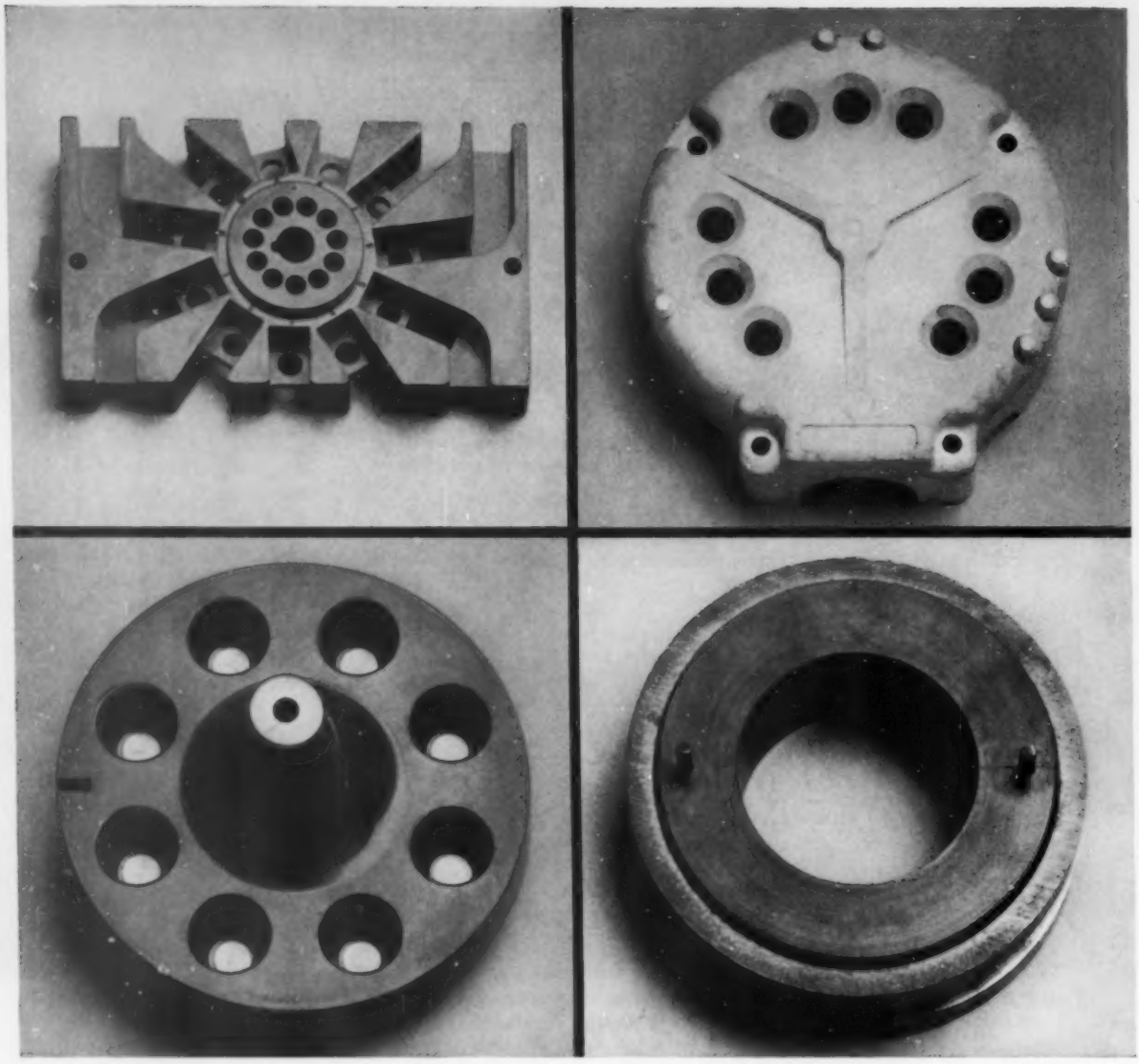
The flow properties of a range of high-density polyethylenes were studied by determining the minimum injection molding pressure to fill the 10-in. disk mold. The materials that were investigated are shown below.

Material	*Density*	*Melt index*
	g./cc.	*g /10 min.*
DMD-6001	0.95	1.8
DMD-6201	0.95	8.7
DMD-7000	0.96	5.0

The data of these experiments, plotted in Fig. 5, p. 113, show several important results. As expected, because of its higher melt index, pressures-to-fill for DMD-6201 were generally about 35% lower than those for DMD-6001 and DMD-7000. Most surprising was the similarity in the pressure-to-fill for the DMD-6001 and the DMD-7000, in view of the large difference in their melt indices. It appears that for a given melt index, a 0.95-density PE exhibits a higher degree of flow under actual molding conditions than a 0.96-density material. This is primarily due to the lower melting point of the 0.95-density polyethylene material and a lesser tendency to freeze during flow.

The advantage of higher-melt-index resins in obtaining faster production rates is also shown in Fig. 5. For example, DMD-6001 must be heated above 600° F. before its flow properties become equivalent to DMD-6201 at less than 400° F. Being able to mold DMD-6201 at 200° F. lower material temperature allows use of a shorter cycle. However, this material has a lower average molecular weight than the DMD-6001 and poorer physical properties.

Therefore, in selecting a resin for a particular molded item, the molder must obtain the right balance of resin flow properties and resin physical properties. These factors plus the proper selection of processing conditions, summarized in Table VI, above, will govern the quality of the injection molded product.—**End**



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You can control brittleness of high-density PE

Methods include control of mold temperature and injection dwell pressure and selection of the right resin

By T. S. Brazier* and B. Maxwell**

Brittle fracture in polyethylene (PE) has been the subject of several recent investigations (1 to 5).[1] Under common mechanical loading conditions, PE exhibits high tensile elongation and ductile behavior after the yield point. However this material will occasionally break with a brittle-type fracture after only a very small elongation. To better understand this transition from ductile to brittle behavior this study was made.

Howard (3) recently reviewed this subject and proposed that brittle fracture can occur in three ways: by "environmental stress-cracking," by "thermal stress-cracking," and by "static fatigue failure." Environmental stress-cracking occurs when PE is exposed to many mobile polar liquids and/or polyaxial stress. Thermal stress-cracking results from long exposure to high temperature and may involve chemical degradation. Static fatigue failure occurs simply under long exposure to stress, such as in a pipe under continuous internal pressure. Although these three modes of brittle fracture may involve separate causes, it is reasonable to assume that the actual fractures are similar since the cracks can be induced by any of the three in the same sample of polyethylene.

Polyethylene is known to be a mix of crystalline and amorphous phases. The degree of crystallinity and crystallite and spherulite size depend on the nature of the polymer. The space between crystallites contains amorphous PE and the amount of amorphous material present depends inversely on the molecular structure of the material and its ability to develop crystallinity. Kafavian (6) and others have shown that the mechanical properties of polycrystalline polymers depend on the amount and nature of the amorphous material between crystallites. In view of this, the amorphous as well as the crystalline phase of the polymer should be considered in any discussion of the effect of molecular structure on brittle fractures.

Increasing evidence (3) shows that brittle fracture can be correlated with molecular weight, molecular-weight distribution, and degree of chain branching. Each of these variables will affect the crystallinity of PE and, in turn, brittle fracture. However, crystallinity will also depend on external factors such as the temperature and pressure history of the material developed in fabrication. To eliminate the effect of processing in ordinary tests, conditioning procedures are recommended (7) so that test methods for brittle fracture may be standardized. However, since the material behavior important to the engineer is that of the "as molded" material, a practical picture of brittle fracture can be gained only in a study of the interrelation between molecular structure and fabrication variables. Using this approach, fabrication methods can be manipulated to produce from polyethylene ductile products which might be characterized as brittle when evaluated by standard tests.

Theory

Commercial polyethylenes are classified according to density into three groups; high-density resins (0.941 to 0.965 g./c.c.), medium-

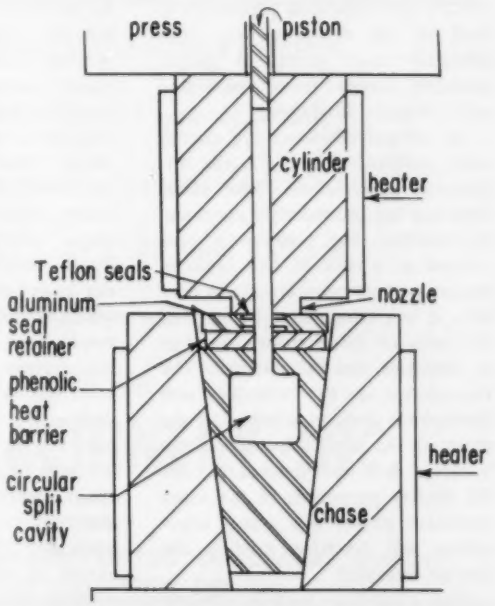

FIG. 1: Schematic cross-section of the experimental molding machine used to study the effect of mold temperature and pressure on the brittle-ductile behavior of high-density polyethylene resin.

*Manager, Chem. Div., General Plastics Mfg. Co., Tacoma, Wash.
**Assoc. Professor, Princeton Univ. Plastics Laboratory, Princeton, N.J.
[1]Numbers in parentheses denote references at end of article, p. 225.
This research was supported in part by a fellowship from the Phillips Petroleum Co., Bartlesville, Okla., and in part by the Army, Navy, and Air Force under Signal Corps Contract DA-36-039-sc-78105.

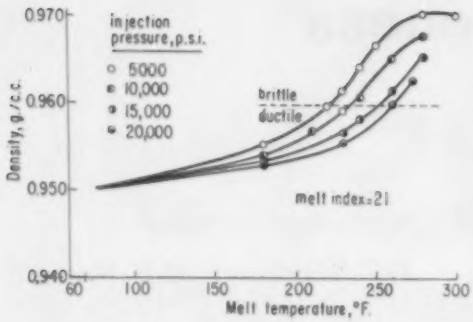

FIG. 3: Effect of changing mold temperature and pressure on density of a Phillips-type, high-melt index, high-density polyethylene resin.

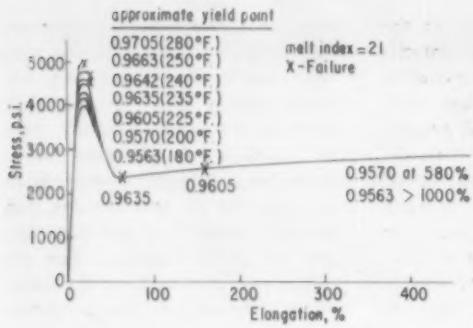

FIG. 4: Changes in stress strain curves of a high-melt index, high-density, Phillips-type resin due to changes in density induced by molding at different mold temperatures (shown in parentheses after density in g./c.c.) at constant injection pressure (5000 p.s.i.).

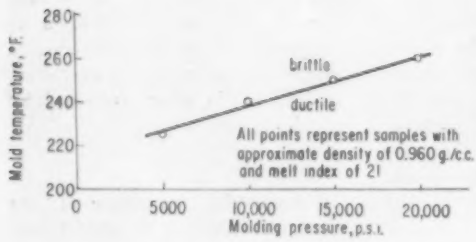

FIG. 5: Brittle-ductile behavior division line for Phillips-type resin. All combinations of mold temperature and molding pressure above line produce samples which exhibit brittle behavior; those below produce ductile behavior.

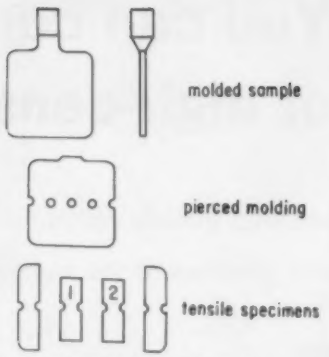

FIG. 2: Molded sample and method of preparing specimens for tensile tests.

density resins (0.926 to 0.940), and low-density resins (0.921 to 0.925) (8). Physical properties as well as the densities vary considerably from group to group, property trends being associated with changes in density.

As all polyethylenes are chemically identical, $(C_2 H_2)n$, the differences which cause these variations are not immediately apparent. If, however, the material is considered as a mix of two separate phases varying considerably in density, it is obvious that by varying the ratio of these phases, a range of densities can be obtained. The two phases are the crystalline and amorphous regions composing the material. As the composition ratio is varied, it is only natural that the PE display properties of the more prevalent phase, but phase interaction will likewise modify the over-all behavior.

The crystalline portion is composed of small polymer crystals called crystallites. The crystallites are homogeneous single crystals of polymer and are formed when polymer chains are parallel and closely packed. Since the molecules vary in length, sharp crystallite boundaries do not exist and long chains extend into amorphous regions and even through several adjacent crystalline and amorphous areas. Amorphous regions exist when parallel chain alignment is not possible. Thus, the extent to which crystallization can occur depends largely on the character of the polymer chains. Chain character will depend primarily on the degree of: 1) chain entanglement, due to the length of the high polymer chains, 2) heterogeneous chain lengths (molecular-weight distribution), and 3) side chain branching (9). The amount and extent of chain branching is the most important variable and is the primary one used to change density in the production of polyethylene.

Branching occurs when a methyl, or larger group, replaces a single hydrogen atom on the chain. The group does not fit into the crystal lattice as easily as the smaller single hydrogen atom and interferes with crystallite formation. Thus, the frequency with which branching occurs will affect the ultimate amount of crystallization possible. Consequently, the greater the branching the lower the ultimate density of the polymer. Low-density PE will have in the order of 2 methyl groups (or branches) per 100 carbon atoms in the main chain, as opposed to 0.8 for medium-density and 0.1 for high-density polymers. Since branching occurs during polymerization, it is an inherent property of the polymer. This places a practical limit on the maximum crystallinity that is possible in a branched polyethylene material.

Similarly, molecular weight and molecular-weight distribution are fixed by the polymerization and also determine inherent crystallinity. If molecular weight is high, chain entanglement becomes a hindrance to crystallization, but this hindrance will be affected by the crystallization conditions. Crystallization rate, varied by fabrication conditions, will allow the long chains to become more or less completely aligned and variations in crystalline content of polymers of similar molecular weight result. A fast crystallization rate will reduce the ultimate crystalline content of a given polymer; a slow rate will increase it. Since crystalline content

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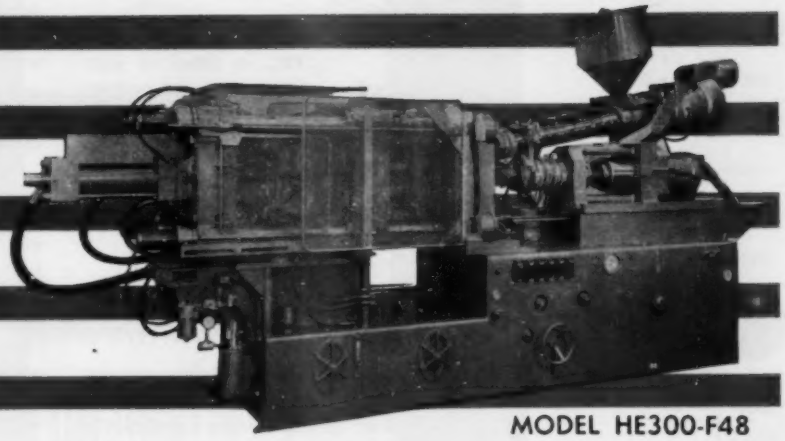

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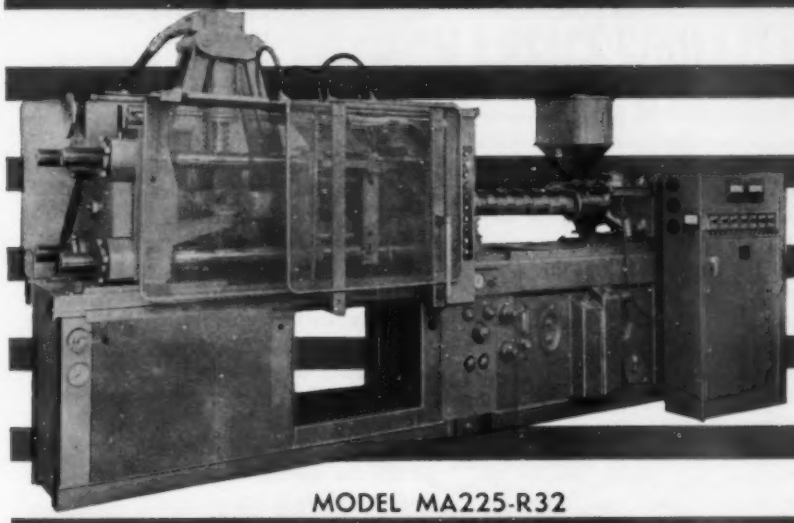

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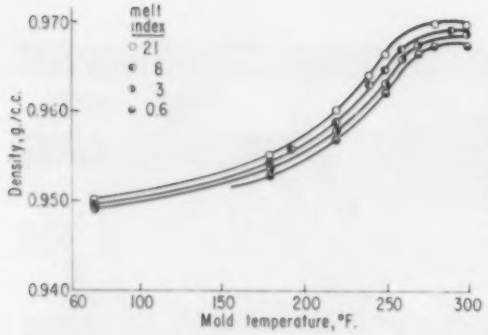

FIG. 6: Effect of mold temperature and melt index on the density of Phillips-type high-density PE at constant injection pressure (5000 p.s.i.)

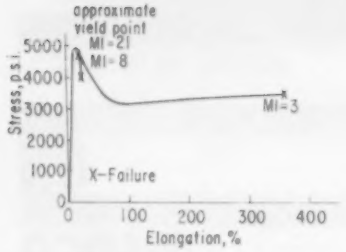

FIG. 7: Stress-strain curves for three different molecular weight Phillips-type high-density polyethylene resins molded at constant mold temperature and pressure (250° F. at 5000 p.s.i.).

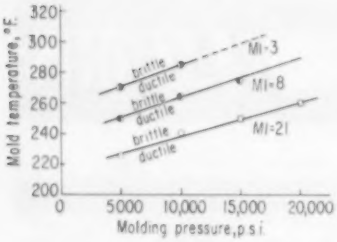

FIG. 8: Brittle-ductile division lines for Phillips-type resins of three different molecular weights (see Fig. 7). Lines represent samples of equivalent density.

determines, in part, the final polymer properties, control of crystallization conditions plays an important part in obtaining desired properties in the fabricated part.

In general, thermoplastics are fabricated into products by melting the polymer, shaping the polymer melt under pressure, and then cooling the polymer to allow it to solidify. When applied to PE, the removal of heat will involve the recrystallization of the amorphous melt and the conditions which normally exist during re-crystallization will influence the crystalline content of the material.

Two variables which significantly influence the crystallization of polyethylene are melt cooling rate (10) and hydrostatic melt pressure during the cooling (11). As cooling rate is increased, smaller crystallite size and lower ultimate crystalline content result. This is due to formation of increased numbers of crystal nuclei and a simultaneous increase in viscosity caused by the rapid cooling. The latter hinders the mobility of the chains and further restricts crystallite growth. Conversely, slow cooling results in the formation of fewer nuclei and larger crystallites, and the increase in the cooling time allows a considerably greater percentage of the polymer to crystallize.

Increasing hydrostatic pressure decreases the specific volume of the polymer melt and forces the chains closer together. This chain packing favors crystallite nucleation, but also increases the viscosity (12) of the polymer, reducing chain mobility. Nucleation under pressure occurs at a higher temperature than that under no pressure. Since the crystallization temperature is changed, a change in the polymer melting point also results. Thus, addition of pressure reduces the crystallite size and ultimate degree of crystallinity unless some compensation in temperature is made.

The importance of the crystalline content becomes apparent when PE is subjected to a continuously increasing strain at product-use temperature. The initial strain is absorbed by elastic mechanisms of the polymer chains in the amorphous regions and a rapid increase in stress occurs. If the amorphous content is decreased, fewer chain segments will be available for elastic deformation and elastic limit of the chain is reached at a lower strain. Thus, increasing crystalline content produces an increase in stress per unit strain, or an increased modulus of elasticity.

When the chain's elastic limit is reached, deformation continues if a permanent deformation mechanism is available. This mechanism is the slippage of amorphous chains relative to each other and a corresponding result is a cold drawing of the material. The degree to which this irrecoverable elongation can occur depends directly on the amorphous content. As the crystalline content is increased, the diminution of the amorphous phase decreases the slippage possible and the result is a brittle material.

Long-term brittle failure in the presence of mobile polar liquids, termed "environmental stress-cracking," is also affected by degree of crystallinity. Although increased crystallinity implies increased solvent resistance and lower permeability, it also results in smaller and more strain-susceptible amorphous regions. As the crystallite size increases, the tangled amorphous chains are fewer and more tightly bound between crystals and yet still must provide the means for material elongation. Highly stressed areas become a target for the solvent action and the resulting brittle failure.

However, highly crystalline material consisting of very small crystallites, although still brittle under a constantly increasing strain, would have a different strain distribution not possible with large crystallites. This suggests that two materials of similar crystalline content could show different resistances to environmental stress-cracking depending on the crystallite size. It also suggests one reason why high-molecular-weight materials which undoubtedly contain a smaller crystalline structure (because of the decreased chain mobility during crystallization) show a greater resistance to stress-cracking.

In addition, consideration should be given to the interrelation of crystallite size and molecular weight. For any given degree of crystallinity and given size of crystallites long polymer chains will pass through a larger number of

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Color, APHA	100
Boiling Water Stability, % Hydrolyzed after 96 hrs.	0.51
Heat Test (2 hrs. at 220°C.) % acid	0.14

Comparison of TXP-126 and DOP in Plastisol Flow Characteristics

Plasticizer 100 PHR	Brookfield Viscosity cps., 25°C. after 1 day	14 days
TXP-126	2,000	1,700
DOP	1,800	3,000

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Comparison of TXP-126 and Polymeric "A" in Milled Vinyl Sheeting

Property	Plasticizer (60 PHR) TXP-126	Polymeric "A"
100% Modulus, psi	1600	1500
Tensile Strength, psi	3000	2750
Elongation Retention, %	90	90
Extraction, % loss		
Soapy Water	1.0	2.1
Activated Carbon	0.7	0.7

Comparison of TXP-126 and DOP in Fused Vinyl Plastisol Film

Property	Plasticizer (100 PHR) TXP-126	DOP
100% Modulus, psi	670	540
Elongation Retention, %	95	10
Low Temp. Flexibility 35,000 psi, °C.	−42	−55
Extraction, % loss		
Soapy Water	2.6	0.6
Heptane	43.0	43.0
Activated Carbon	1.3	2.8

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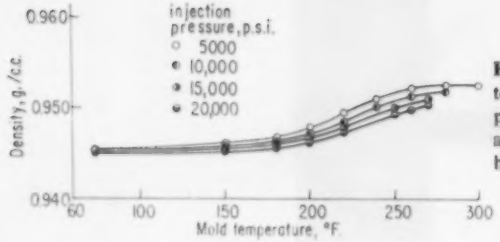

FIG. 9: Effect of mold temperature and molding pressure on the density of a 4-melt-index, Ziegler-type, high-density polyethylene.

crystallites than will short chains. Conversely, if fabrication conditions are manipulated to produce increased crystallite size, fewer and fewer chains would pass through more than one crystallite especially in low-molecular-weight polymers, thus reducing the cohesion between crystallites. This is confirmed by Howard's data (3) which shows a marked decrease in environmental stress-cracking resistance as molecular weight is decreased. On the other hand, if proper adjustments were made in fabrication conditions to produce a large number of crystallites of the smallest possible size, even low-molecular-weight polymer chains would pass through many crystallites, thereby imparting a considerably high cohesion to the plastic material.

Procedure

To determine the effect of molding conditions on the ductile-brittle structural transition it was necessary to develop test molding equipment in which the actual temperature and pressure in the mold cavity itself could be accurately controlled. In conventional presses, measured injection pressure is never applied to the polymer in the mold cavity due to pressure losses in the cylinder, sprue, runners, and gate.

To minimize this loss, a special air-actuated injection machine was built in which the usual torpedo was eliminated and the injection cylinder connected directly to the mold cavity without a sprue, runner, or gate (see Fig. 1, p. 125). To intensify the effect of mold temperature, test specimens of small thickness were used. This small thickness produced as uniform a temperature as possible across the specimen during cooling, while being sufficiently thick for mechanical tests.

The specimen

Specimens were specially designed for the brittle failure tests to be performed. They were 0.030 in. thick, 0.25 in. wide, and 0.75 in. long. In each specimen a test section, 0.125 in. wide and 0.125 in. long, was made by punching out two 0.125-in.-diam. semi-circles at opposite edges of the 0.25-in. strip, as shown in Fig. 2, p. 126. The design of the specimen was governed by the desire to have a test section in which a biaxial stress concentration could be produced. Biaxial stress is necessary to produce long-time brittle failure of polyethylene (13).

Test results for the material were reproducible within a reasonable experimental error.

The specimens were cut from the injection molding. The machine, shown in Fig. 1, allowed molding of one sample per cylinder filling and allowed molding pressure to be maintained on the material during the entire cooling cycle. The injection cylinder was loaded through the nozzle with ¼-in. rod, 3 in. long, which previously had been molded in a conventional manner.

An injection cylinder temperature of 350° F. was used during the entire investigation; preliminary studies with variations from 350 to 500° F. were tried, but no appreciable difference in short-time properties was observed.

Mold temperature was controlled from room temperature to 300° F. Because many runs were made with mold temperatures above the polymer melting point, a pressure-tight system was necessary.

The cylinder was loaded with a single rod which was allowed to heat for 1 minute. The molten charge was then injected into the mold held at the desired mold temperature. If mold temperature was below 180° F., 1 min. of cooling was allowed before injection pressure was released and the sample ejected. At mold temperatures above 180° F., the mold was air-cooled immediately following the injection and injection pressure was maintained until the mold reached 150° F., at which point the specimen was removed. The air-cooling system produced a drop in mold temperature of approximately 10° F. per min.; cooling time was therefore governed by the initial mold temperature.

Testing methods

Brittle fracture tests were performed using a tensile test at constant strain rate to evaluate short-time failure, and a tensile stress-relaxation test for the long-time test. The constant-rate tensile test was used to obtain the stress-strain curves, and showed immediate differences caused by molding condition variations. The stress-relaxation tests were also run in tension, and measured the load-carrying time prior to the long-time brittle failure of the specimen.

The short-term tensile tests were performed on a small mechanical tensile testing machine, at a constant speed of 0.05 in. per minute.

The load measuring system was activated with a 4-active-element strain gage bridge. The strain gage output was fed to a recording millivoltmeter. The strain gages were mounted on a steel cantilever beam which was constructed to allow a

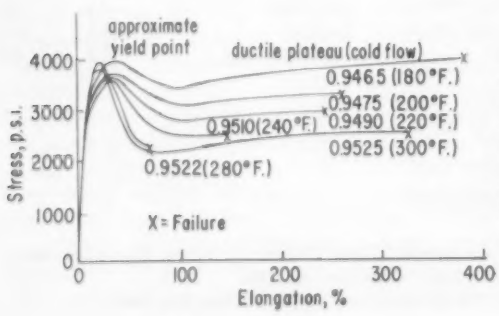

FIG. 10: Stress-strain curves for a 4-melt-index, Ziegler-type resin molded at constant pressure (5000 p.s.i.) showing how fabricating condition induced density differences can affect the ductile-brittle behavior of material.

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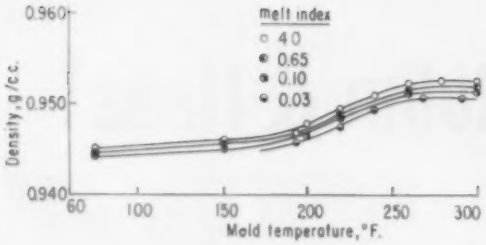


FIG. 11: Curves for four different melt index, Ziegler-type, high-density PE resins, showing effect of molding temperature and molecular weight on density at constant pressure (5000 p.s.i.).

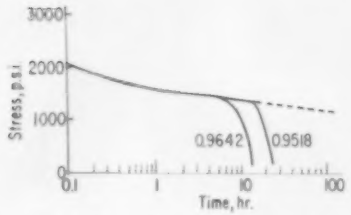


FIG. 12: Relaxation curves for two samples of Phillips-type, high-density PE. Difference in density between the two samples was induced by varying molding conditions, using same resin. Dotted line shows behavior expected for material if ductile-to-brittle behavior transition did not occur.

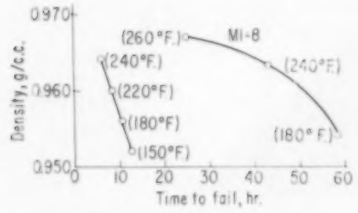


FIG. 13: Time-to-fail (in relaxation test) as a function of mold temperature variation - induced density changes in two different melt-index, Phillips-type resins. Injection pressure was held at a constant 5000 p.s.i.

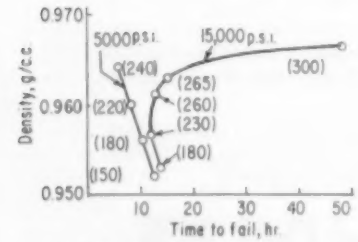


FIG. 14: Time-to-fail as a function of density and molding pressure for a high-melt index (21), Phillips-type, high-density polyethylene resin. Approximate mold temperatures, °F., shown in parentheses.

0.003-in. deflection at a 20-lb. dead weight load, which was the maximum load encountered during this experimental work. This deflection was neglected during the strain calculations as it represents an error of less than 3% in all cases and considerably less than this in the majority of the runs.

The calibration of the bridge and recorder was accomplished by using a dead weight method, and the calibration was re-checked after each run was completed.

The long-time brittle failure tests were also run in the same machine by applying a pre-determined stress to the samples, 4000 p.s.i., and recording the decay or stress until failure. To evaluate the effect of a mobile polar liquid on the long-time brittle failure, Igepal CO-630 was applied to the stressed area prior to the application of the load and allowed to remain on the sample throughout the stress-relaxation test. All tests were performed at ambient room temperature.

Molded specimen densities were measured in a gradient density column (isopropanol and water) maintained at 25 ±0.1° C. and calibrated to four decimal places with standard glass floats.

Results

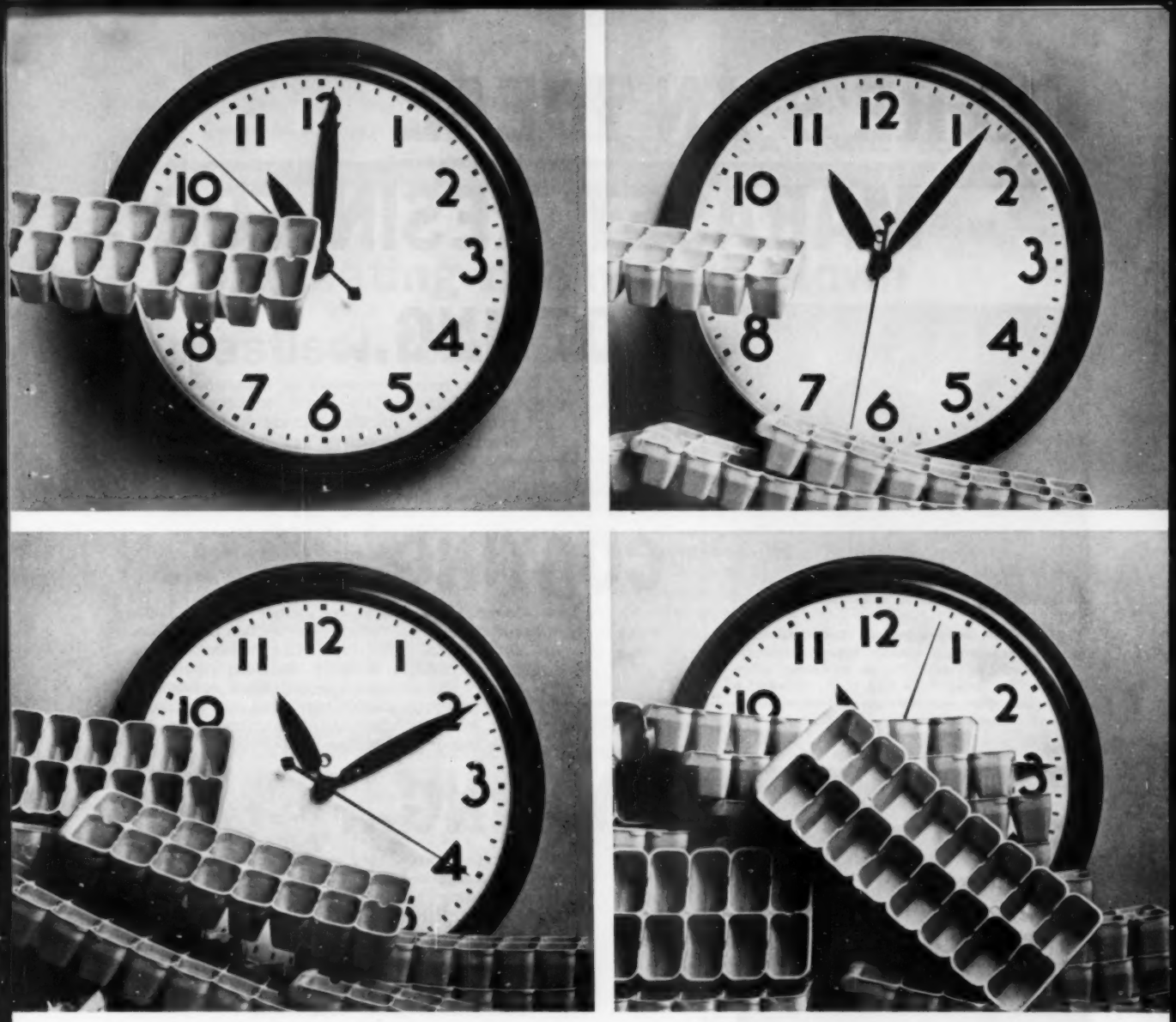
Variations in PE's crystalline content result in a wide range of physical properties. To evaluate these properties and to interpret properly the values obtained, the degree of crystallinity must be controlled or at least known. Since crystallinity changes are accompanied by density changes, density is a convenient measure of crystalline content. Fig. 3, p. 126, shows the variations in density of a linear PE produced by molding under various conditions of temperature and pressure. As mold temperature increases at constant pressure, the cooling rate decreases, allowing a longer time for crystallization. This results in a more dense and crystalline material.

As pressure is increased at a given mold temperature, density decreases, which can be attributed to the apparent increase in polymer melting temperature. The flattening of the curves at both high and low mold temperatures indicates a maximum and minimum density obtainable with this equipment and sample thickness. Wider variations in molding conditions and longer crystallization periods could produce both higher and lower densities than those shown.

Stress-strain data were taken from samples distributed within this density range. Fig 4, p. 126, shows the variations in the curves, due to changing density, which result in a low-molecular-weight material by varying only mold temperature, at a constant 5000-p.s.i. injection pressure. The curves obtained are typical of ductile, plastic materials: a steep initial rise, followed by a leveling off as the material yields. The slope of the initial straight portion of the curve is a measure of tensile modulus (straining rate of 0.05 in./min.).

Maximum tensile strength is indicated by the peak of the curve at the yield point. Elongation or strain up to the yield point is largely recoverable and is a measure of the elastic component in the viscoelastic material. Following the yield point there is a sudden drop in tensile stress followed by ductile behavior. Strain after the yield point is a non-recoverable elongation resulting from plastic flow. The ability of the PE to exhibit this plastic flow increases rapidly as the density of the material is brought below 0.9605. By processing at this density there is a division between ductile and brittle behavior of the material. The term "brittle-ductile division" is now used to denote the density above which the material exhibits no ductile plateau after the yield point has been reached (taken as 0.9605 g./c.c. in Fig. 4). The material with a density of 0.9605 was chosen since it is the first to exhibit ductile behavior. As the density increases above this value, a slightly stronger, but also more brittle, material is obtained.

Similar stress strain curves were obtained at injec- **(To page 217)**



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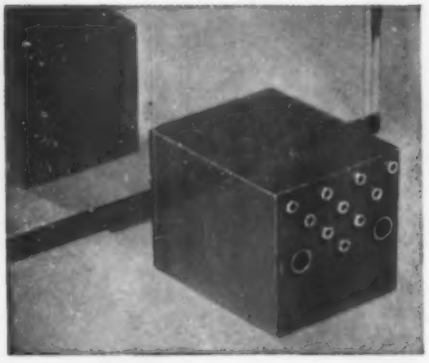

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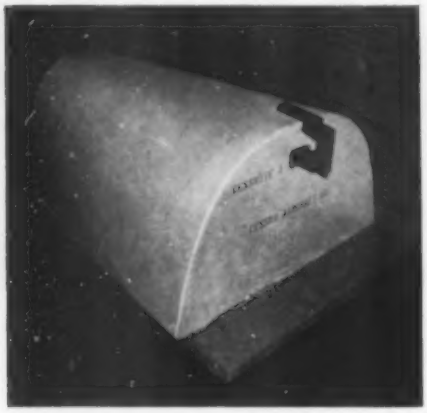

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Formulating chemically blown plastisol foam

By Arnold C. Werner†

During the past two years, the introduction of the vinyl foam-fabric laminate has provided the fabric coating field with a new and novel product which does an excellent job of simulating soft leather. This relatively new application represents several million pounds of chemically blown plastisol foam compound each year. Since these foamed products may be produced via the plastisol technique, a need has arisen to better understand the function of each of the formulating ingredients in these compounds. This article presents data on the effects of fusion and blowing temperatures, type and amount of blowing agent, plasticizer, and stabilizer, and viscosity on the density and quality of such plastisol foam.

The fundamentals involved in preparing a plastisol have long been known. The term plastisol covers the dispersion of a polyvinyl chloride, or copolymer resin in its finely divided form, into a plasticizer or combination of different plasticizers. To this fluid paste are added various ingredients to enhance heat stability, modify rheological characteristics, and for other purposes. With the application of heat sufficient to bring the vinyl compound into the 300 to 400° F. range, the vinyl resin and plasticizer become homogeneous and form a solid solution. Upon cooling, this thermoplastic mass, depending upon formulation, becomes a dry cohesive plastic possessing handling properties ranging from very tough and hard to soft and flexible.

The introduction of blowing agent to produce a cellular prod-

*Reg. U. S. Pat. Off.

†Marvinol Development, Naugatuck Chemical Co.

Based on a paper presented at the S.P.E. RETEC in Buffalo, N. Y., Oct. 1961.

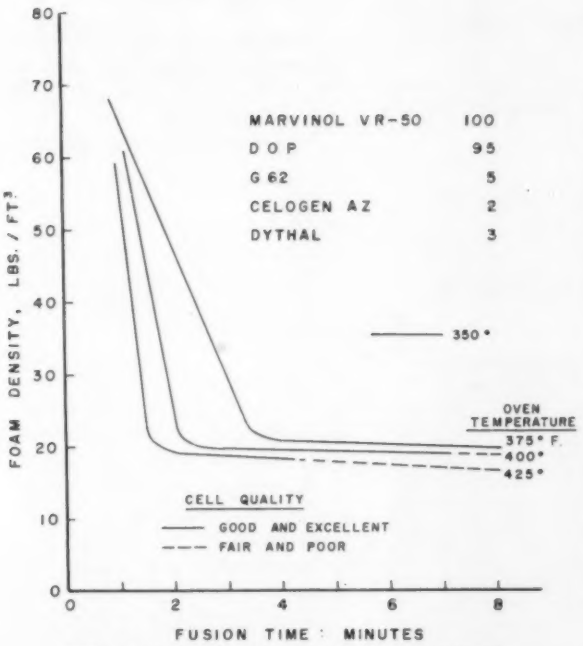


FIG. 1: Foam densities produced from plastisol resin with specific viscosity of 0.50.

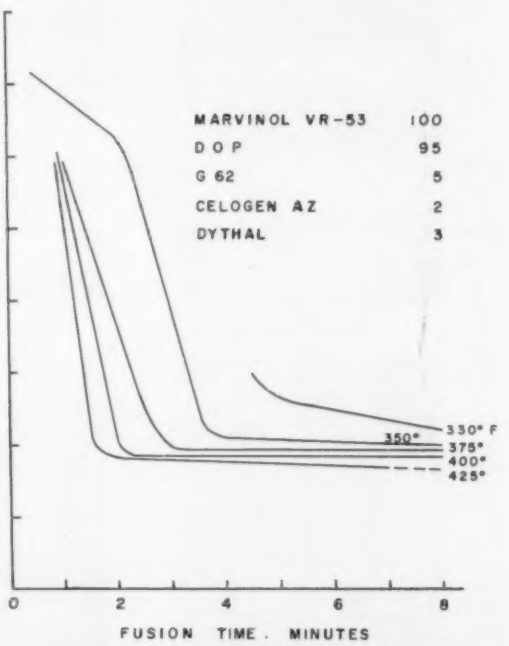
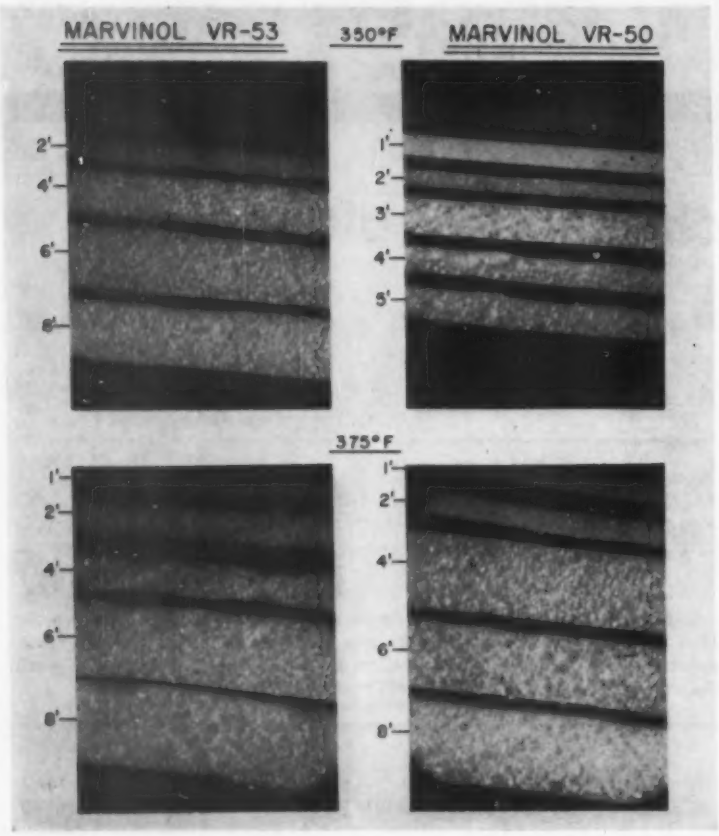


FIG. 2: Foam densities produced from plastisol resin with specific viscosity of 0.35.



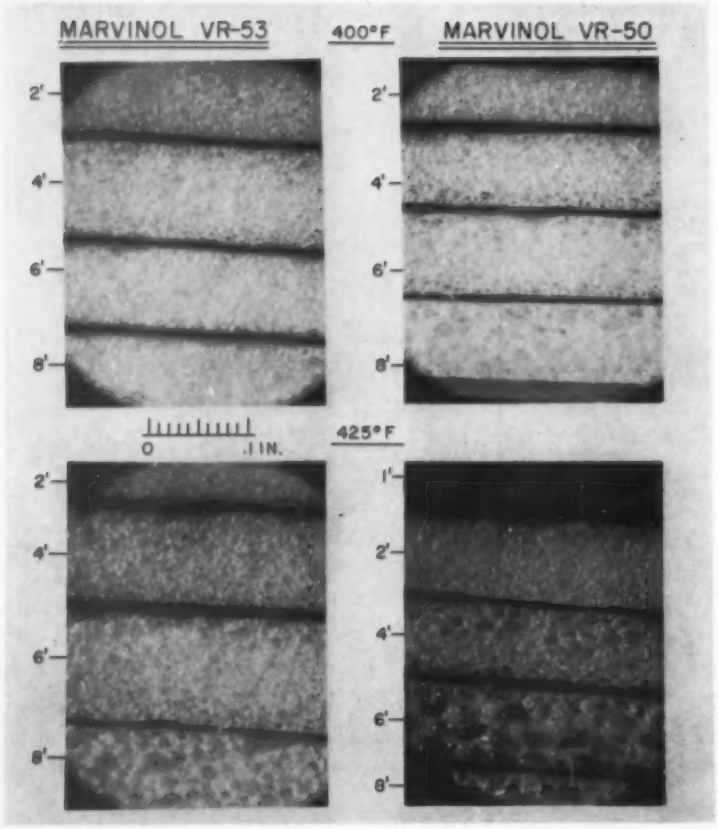


FIG. 3: Cell structure as a function of fusion time and temperature. Note that in all of these photographs the thickness of the foam samples is a function of the thickness of the original casting which varied; therefore, thickness is not to be used as a measure of foam density.

uct changes none of the above conditions. It merely adds another, *i.e.*, the decomposition of the blowing agent used should occur when the vinyl plastic is sufficiently cohesive to retain the gas developed. This would include the pregelation period (low temperature) and the fused or semi-fused state (high temperature). This report specifically discusses systems involving blowing agents that decompose when the vinyl resin has reached the fused state.

Fusion temperature requirements

Consistent with current practice, a relatively soft compound was used in this study; it was prepared with 100 parts plasticizer per 100 parts resin and sufficient blowing agent to produce a relatively low density product, *viz.*:

PVC plastisol resin	100
DOP	95
Paraplex G62 (epoxy)	5
Dythal (lead stabilizer)	3
Celogen AZ (blowing agent)	2

A description of these and other compounding ingredients used in this work appears in the table on the facing page.

This compound was prepared

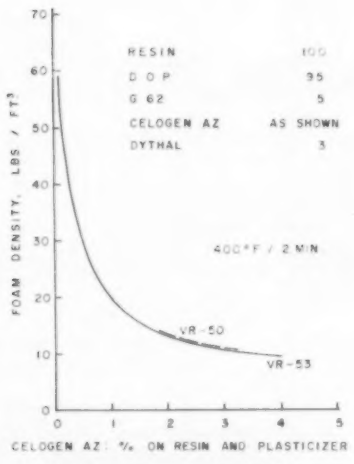


FIG. 4: Foam density as a function of the blowing agent concentration.

via normal plastisol mixing techniques which include predispersing both blowing agent and stabilizer in plasticizer on a three-roll paint mill. To note the effect of plastisol resin selection on fusion and blowing requirements, two sets of samples were prepared based on resins of different molecular weights. Thin castings were made on steel plates, and fused and blown under a wide variety of oven temperature and time conditions. The quality of the resultant foams was checked by foam density measurements and a visual inspection of the uniformity and size of the cells produced.

Figures 1 and 2, p. 135, plot the foam densities produced at oven-air temperatures ranging between 330 and 425° F., with fusion times up to 8 min. for compounds based on Marvinol VR-50 and VR-53. The specific viscosities[1] of these two plastisol resins are 0.50 and 0.35, respectively; the specific viscosity measurements are also an approximate measure of molecular weight.

Figure 3, at left, shows the cell structures, as photographed through a microscope, of the two sets of samples, fused and blown under the varying time and varying temperature conditions.

An examination of the data in Figs. 1 to 3 indicate the following assumptions:

1. Ultimate density of the foam is dependent upon the complete decomposition of the blowing agent and virtually independent of time and temperature provided the minimum values required for blowing are exceeded.

2. Ultimate density is essentially independent of the specific viscosity of the plastisol resins used.

3. Higher temperatures reduce the time that is required for complete blowing.

4. Formulations based on the lower specific viscosity resin may be blown at lower oven temperatures. They also produce good quality foam over a wider range of fusion conditions. Subsequent experiments, as discussed later, will qualify some of the above conclusions in terms of plasticizer level, cell quality, resin type, etc.

It is interesting to note that the actual decomposition of the blowing agent, Celogen AZ, occurs during and after the vinyl has actually fused. Fused but unblown samples have a yellow cast imparted by the undecomposed Celogen AZ. As heat history develops, the unpigmented foam turns white as the Celogen AZ is activated, thus providing a rapid colorimetric means by which to determine optimum blowing conditions.

[1]Specific Viscosity $= \frac{\text{solution viscosity}}{\text{solvent viscosity}} - 1$ where the solution consisted of 0.2 g. of polymer dissolved in 50 ml. of nitrobenzene.

Materials used in the blown plastisol foams

Material	*Type*	*Supplier*
Resins		
Marvinol VR-50	Plastisol-grade PVC resin, specific viscosity 0.50	Naugatuck
Marvinol VR-53	Plastisol-grade PVC resin, specific viscosity 0.35	Naugatuck
MX 5301	Experimental plastisol-grade PVC resin, specific viscosity 0.30	Naugatuck
Plasticizers		
DOP	Di-2-ethylhexyl phthalate	—
TCP	Tricresyl phosphate	—
DIDP	Diisodecyl phthalate	—
Paraplex G-54	Polyester	Rohm & Haas
Paraplex G-62	Epoxydized soybean oil	Rohm & Haas
Stabilizers		
Dythal	Dibasic lead phthalate; pigment	National Lead
Dyphos	Dibasic lead phosphite; pigment	National Lead
6V6A	Barium-cadmium-zinc type; liquid	Harshaw
1237	Barium-cadmium-zinc chelate type; liquid	Ferro
1720	Barium-cadmium-zinc chelate type	Ferro
BC206F	Barium-cadmium-type; liquid	Advance
LO24	Lead carboxylate	Advance
Viscosity modifiers		
Santocel CX	Silica; high oil absorption pigment	Monsanto
Dispersol	Essentially aliphatic, high boiling diluent	Shell
Blowing agents		
Celogen AZ	Azodicarbonamide; powder. Also available in paste form	Naugatuck
Celogen	p,p'-oxybis(benzenesulfonyl hydrazide); powder	Naugatuck

Blowing agent concentration

The role of blowing agent in reducing foam density over a wide range of blowing agent concentrations is shown in Fig. 4, p. 136. Cell quality for these compounds is shown in Fig. 5, p. 138. These data show 1% of Celogen AZ to be the most economical level to work with, although the actual amount required would be dependent upon the requisite density. These data again show the importance of resin selection in formulating low-density foams.

Commercial vinyl foam-fabric laminates are generally a few mils thick by comparison with the relatively heavy castings made for facile evaluation in this report. Consequently, a study of foam

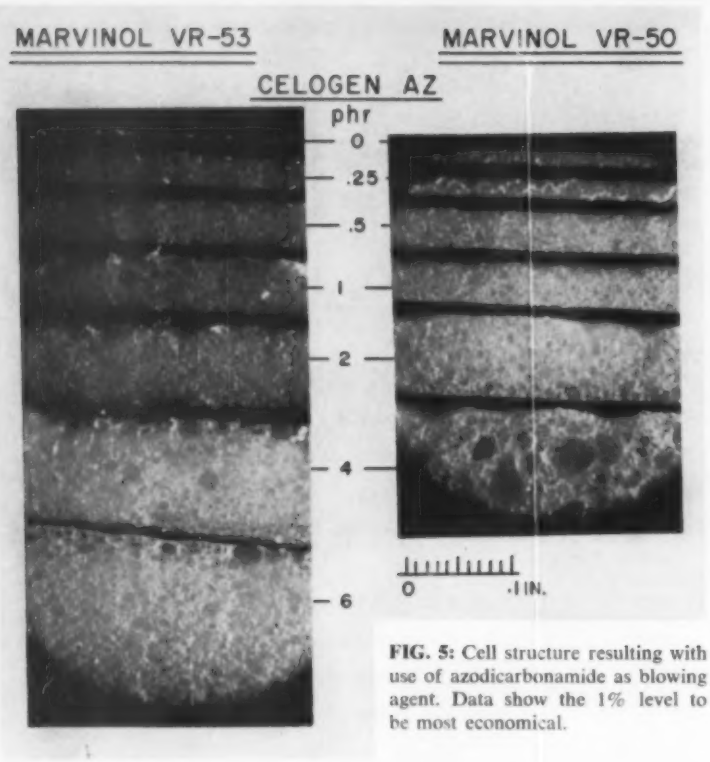


FIG. 5: Cell structure resulting with use of azodicarbonamide as blowing agent. Data show the 1% level to be most economical.

thickness and cell quality was made. No loss in cell quality or density was observed in thicknesses between 20 and 130 mils.

Plasticizer level

The current foam-fabric laminate, in an attempt to duplicate soft leather, contains a relatively high plasticizer concentration (about 10 p.h.r.). Duplication of the harder leather products would require a reduction in plasticizer level. Evaluations of foam formulations at plasticizer concentrations of 60, 80, 100, and 120 p.h.r. are shown in Figs. 6 and 7, below. The superior performance of the lower molecular weight resin Marvinol VR-53 at low plasticizer levels is indicated.

Since the Celogen AZ level was held constant at 2 p.h.r. for all plasticizer levels, the amount of blowing agent, based on total compound weight, as a consequence increases for the lower plasticizer levels. Hence, the drop in density of the foam as plasticizer levels are decreased.

To further examine the relationship between foam density and blowing agent level at a variety of plasticizer levels, several compounds were tested with Celogen AZ levels up to 4.5% (based on resin plus plasticizer) and plasticizer levels varying from 50 to 120 p.h.r. These data (Fig. 8, p. 141), show that foam density is independent of plasticizer level and completely dependent upon the amount of blowing agent present when that level is based upon the total compound and not the resin (p.h.r.) alone.

Plasticizer selection

Due to the desirability of some plasticizer types over others, a study of the quality of foam to be expected with different plasticizers was made. Figure 9, p. 141, shows foams produced from plastisols based on DIDP, TCP, Paraplex G-54, and DOP. These data indicate that, at a 100-p.h.r. level, perfectly adequate foams may be

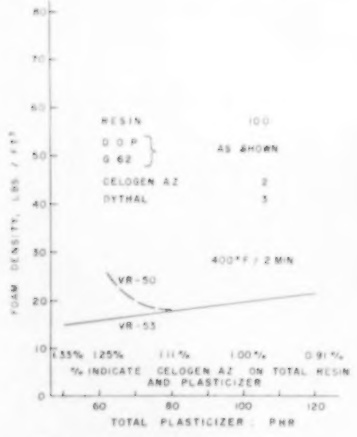


FIG. 6: Effect of varying plasticizer concentration.

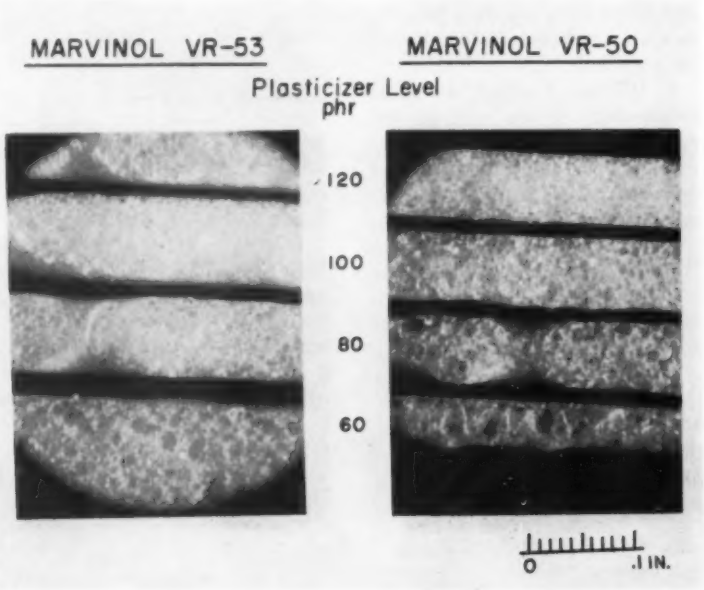
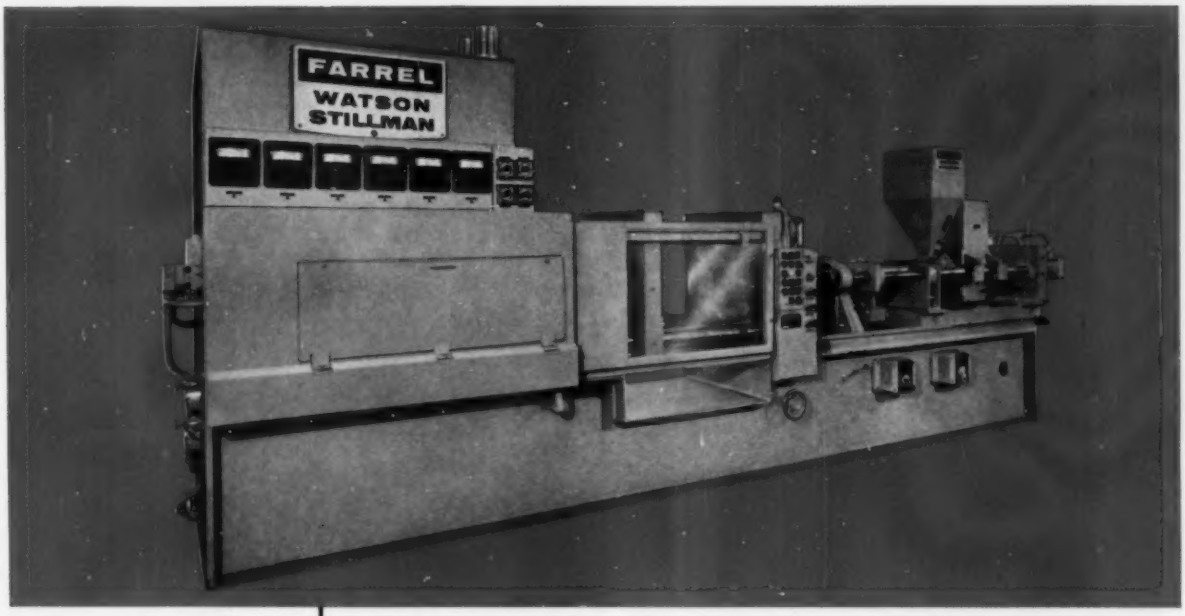


FIG. 7: Cellular quality at various plasticizer levels.



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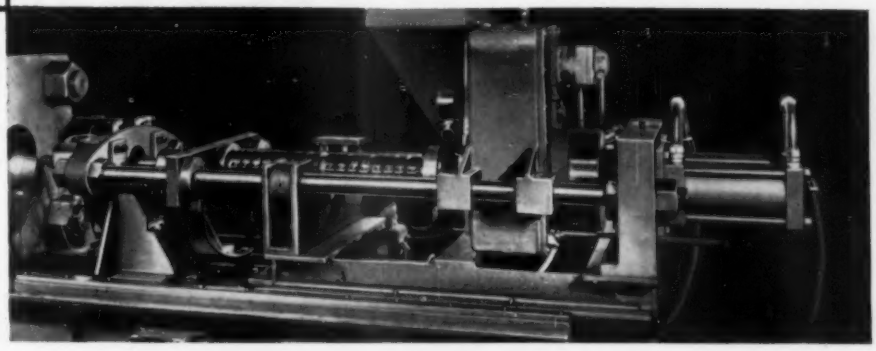

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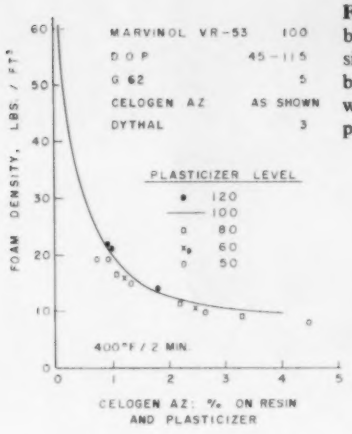

FIG. 8: Relationship between foam density and amount of blowing agent that was used at various plasticizer levels.

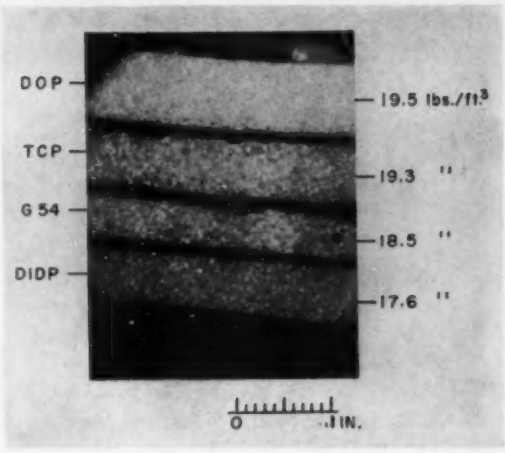

FIG. 9: Cell quality of plastisol foam produced with four different plasticizers.

produced from a wide variety of plasticizers. Since the decomposition of the blowing agent occurs after gelation[2] takes place, such factors as room-temperature viscosity and gelation rate of the plastisol are virtually of no consequence, which is not the case when the various blowing agents which decompose at temperatures prior to gelation are used.

Stabilizer selection

Although lead stabilizers have been found to be the most effective in activating Celogen AZ, their use is not mandatory. Certain barium-cadmium-zinc types may be used, as well as no stabilizer at all. The main difference among these systems is the time required to develop foam (Fig. 10, right). Whereas a lead stabilizer such as Dythal or Dyphos will activate the Celogen AZ in about 2 min. at 400° F., a barium-cadmium-zinc type requires 4 min.; with no stabilizer present, except for the epoxy plasticizer present in all these formulations, 6 min. is required for activation at the same temperature.

Although 3 p.h.r. of Dythal was used throughout this work as a vinyl stabilizer and activator for the blowing agent, it was found that far lesser amounts could be used. Levels as low as 0.5 p.h.r. were adequate to produce foam on the same time-temperature schedule as 3 p.h.r. Other materials, *e.g.*, zinc oxide, were also found to be useful in activating Celogen AZ, and may be of interest where lead stabilizers cannot be used because of toxicity or staining problems.

Viscosity modifications

In the processing of foam plastisol compounds, it may be necessary to modify their flow properties. To build a yield value, effective in preventing strike-through, the high oil absorption fillers, *e.g.*, Santocel and Cabosil, may be used. If viscosity reduction is required, aliphatic diluent may be added.

Figure 11, p. 142, illustrates the density and cell structure obtained when the standard foam plastisol formulation (see Fig. 2) is modified with 2 p.h.r. Santocel CX and 5 p.h.r. Dispersol, respectively. It has been found that increased amounts of the high oil absorption filler will produce larger cells. Increased levels of diluent will result in poorer cells and an apparent rupture of the cell wall.

Deaeration and fillers

The deaeration of a foam compound on the basis of these studies does not appear to be necessary. In fact, deaeration causes no loss in density but does result in a considerable loss in cell quality. (Fig. 12, p. 142). Also shown in Figure 12 is the cell structure of the standard plastisol foam compound containing 40 p.h.r. of calcium carbonate filler. The higher density for this foam reflects the higher specific gravity of the plastisol.

Blowing temperature

The use of oven-air temperature and time to describe the fusion and blowing requirements for a foam plastisol does not describe the thermal state of the plastic sufficiently well for a study of this kind. Consequently, a pair of thin thermocouple wires was inserted into the plastic at two different oven-air temperatures to record the temperature rise of the sample. The temperature development and degree of blow in these samples are shown for both in Figs. 13 and 14, p. 142.

In both studies, blowing agent decomposition commences at about 300° F. and is completed by the time the plastic has reached 350° F. These data show foaming and fusion occurring simultaneously as previously discussed, and definitely place the foaming process in the fused hot-melt flow region of the plastic.

The various relationships between resin, plasticizer, and blowing agent concentration are sum-

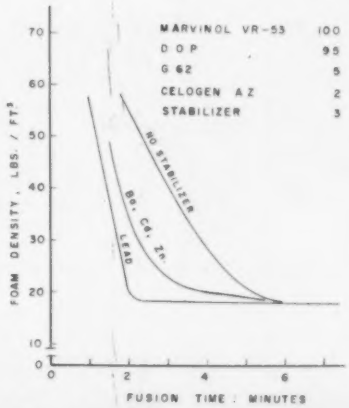

FIG. 10: Effect of barium-cadmium-zinc and lead stabilizers on foaming time.

[2]Gelation applies to the state of the plastisol just after passing through its high viscosity phase as a result of partial resin solution. The plastisol is in a solid, cheesy, noncohesive state at this point.

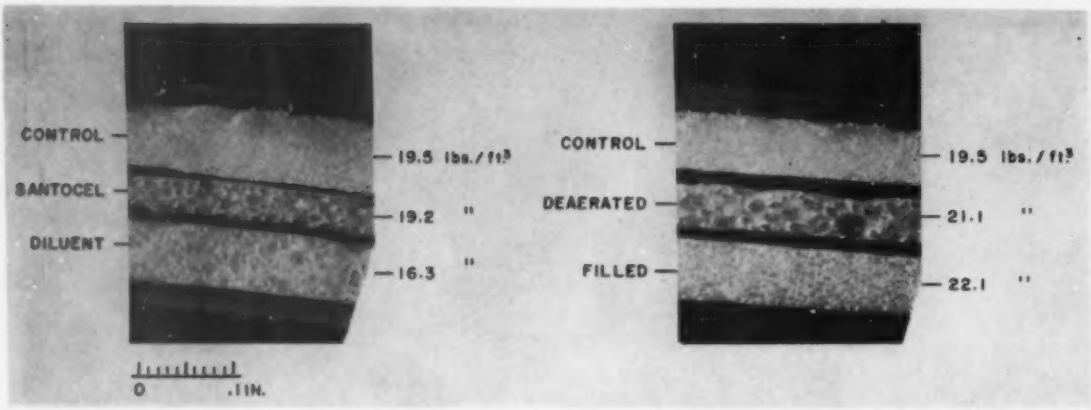

FIG. 11: Effect of high-absorption filler and diluent on density and cellular structure.

FIG. 12: Cell structure resulting from deaeration and use of calcium carbonate filler.

med up in Fig. 15, p. 145. This graph plots foam quality as a function of Celogen AZ and plasticizer levels for Marvinol VR-50 (specific viscosity 0.50), Marvinol VR-53 (specific viscosity 0.35), and an experimental low-molecular-weight plastisol resin MX 5301 (specific viscosity 0.30). The lines separating "good" and "poor" quality foam are arbitrarily drawn to delineate between these two general areas. A study of this graph shows that greater flexibility in formulating low-density foam can be accomplished at higher plasticizer levels and/or through the use of lower molecular weight resins.

In Figures 13 and 14 it was established that blowing agent decomposition with Celogen AZ occurs when the vinyl is in a hot-melt state, capable of expanding under the pressure of the evolving gas, but sufficiently cohesive to retain the gas in a cellular structure. Since lower molecular weight resins and higher plasticizer levels both contribute to increase hot-melt fluidity, one may conclude that successful foam is the result of a compound being sufficiently mobile *in the blowing agent's decomposition temperature range* to expand with the developing gas into a uniform cellular product.

A cursory study of the hot-melt flow properties of the two resins at various plasticizer levels and temperatures (Figs. 16 and 17, p. 145), reveals a familiar pattern. This study, using techniques established by Wolstenholme and Roggi[3] with

[3]W. E. Wolstenholme and P. E. Roggi, "Rheological study of vinyl calendering compounds," Modern Plastics 37, 131 (Mar. 1960).

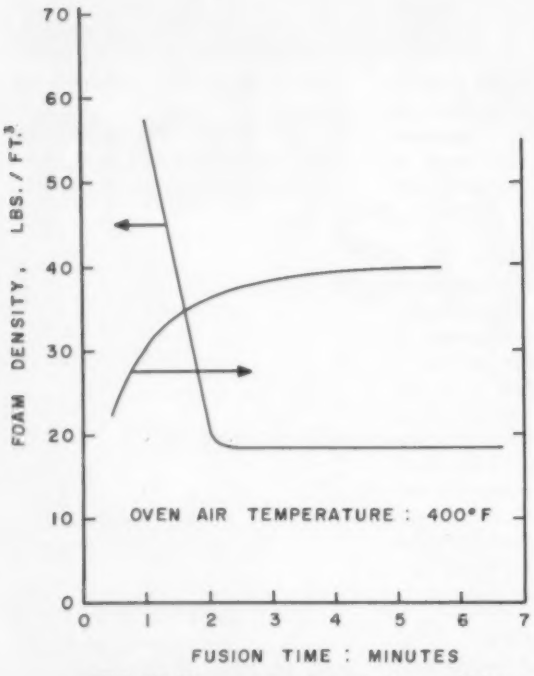

FIG. 13: Temperature rise and degree of blow at oven air temperature of 400° F.

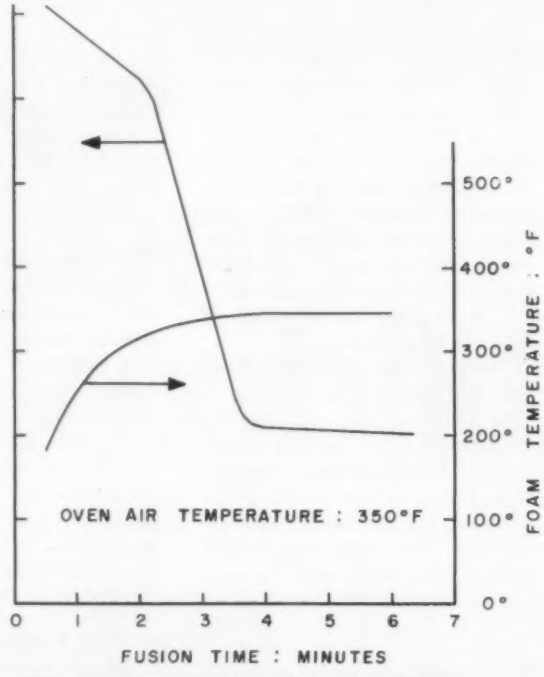

FIG. 14: Temperature rise and degree of blow at oven air temperature of 350° F.

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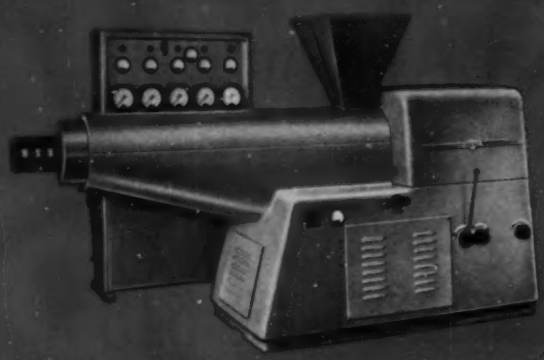

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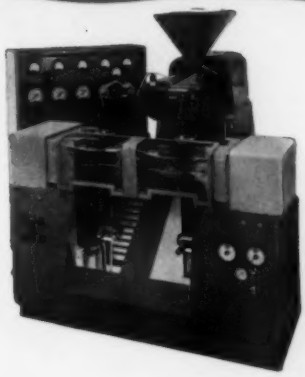

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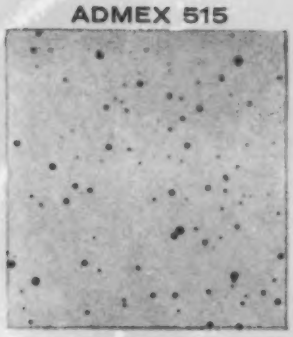

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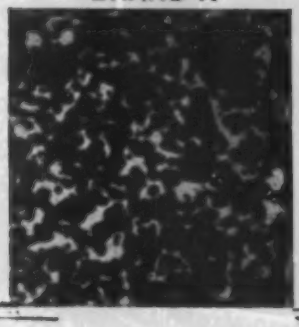

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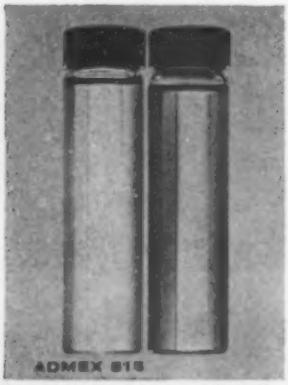

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a Mooney viscometer, shows the general drop in hot-melt viscosity with reduced molecular weight of the resin, increased plasticizer, and higher processing temperature.

Blowing agent selection

Since foam vinyl based on Celogen AZ requires heat in excess of that actually required for fusion, the possibility exists that some fabric coaters will find their ovens with insufficient capacity to handle the new foam-fabric laminate. With the availability of Celogen, a possibility exists for reformulating plastisol foam for lower temperature blowing.

Due to the lesser amount of gas liberated by Celogen, the amount (4 p.h.r.) of Celogen used was double the Celogen AZ level (2 p.h.r.) in the standard recipe. A series of time-temperature-density curves was developed for this formulation in combination with VR-50 and VR-53. (Fig. 18, below). A comparison with similar data obtained on VR-53 with Celogen AZ at 350° F. (Fig. 2) indicates the more rapid development of foam with Celogen due to the lower decomposition temperature of Celogen, compared to that of Celogen AZ.

A similar study of the Celogen system using the higher molecular-weight VR-50, by comparison with VR-53, failed to produce a satisfactory foam on any schedule, including 400° F. This supports the theory that the plastic mass must be sufficiently mobile in the decomposition temperature range of the gas in order to expand with it to form a low-density foam.

Future applications

The technical points covered in this discussion may be of interest to the vinyl plastisol formulator for current applications as well as future developments. Potentials exist in many fields. Vinyl play balls for children, rotationally molded from plastisol compounds containing very modest amounts of blowing agent, possess rebound properties superior to balls molded with conventional unblown compounds.

In the fabric-coating field compounds containing only small quantities of blowing agent give drape and hand qualities normally associated with com- **(To page 227)**

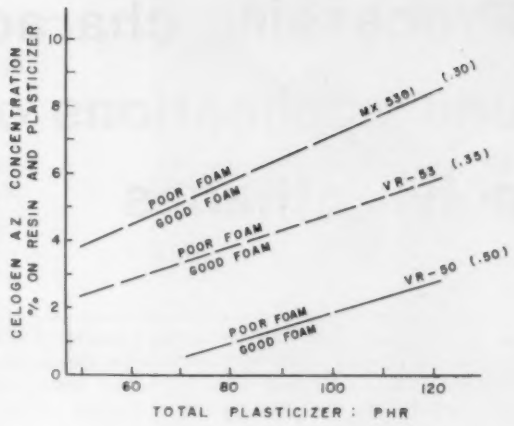

FIG. 15: Foam quality as a function of blowing agent concentration and plasticizer levels for three resins.

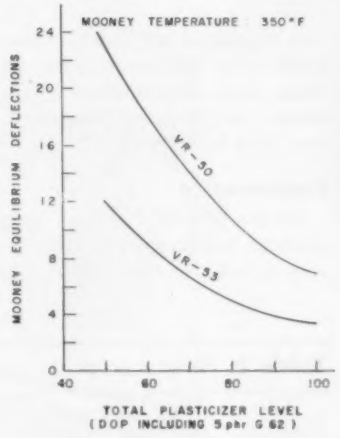

FIG. 16: Effect of plasticizer level on hot-melt flow.

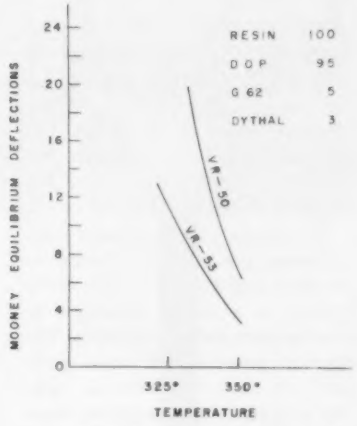

FIG. 17: Effect of processing temperature on hot-melt flow.

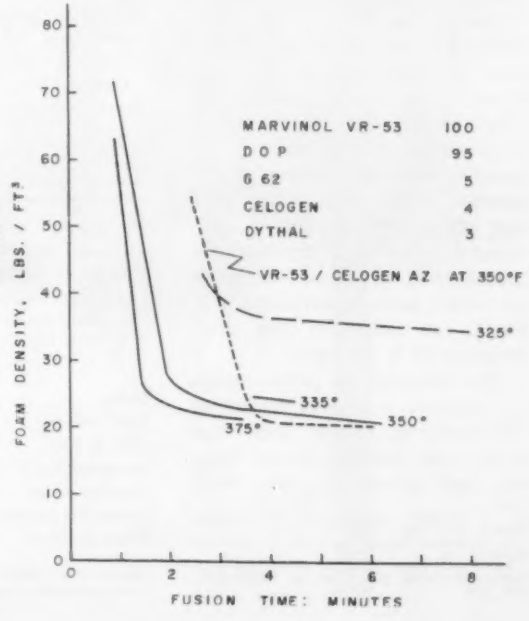

FIG. 18: Development of foam using blowing agent with low decomposition temperature.

Processing characteristics and applications of thermoplastic polyurethanes

By C. A. Waugaman*

Thermoplastic Estane polyurethanes make it possible to obtain the polyurethane materials in products made with conventional thermoplastic processing equipment and solution techniques. Their applications include injection and compression molded items, calendered sheeting, coatings and finishes, and extruded jacketing, tubing, and profiles.

The use of elastomeric polyurethanes for extrusion, molding, calendering, and surface coating has increased greatly in the last 5 years. These polymers are noted for their high tensile and tear strength, good solvent and ozone resistance, and excellent abrasion resistance.

The Estane[1] thermoplastic polyurethanes are essentially linear in structure and do not require crosslinking or a curing operation to develop their useful properties. The physical properties of these polymers are shown in Table I, right. The properties are similar to those of the crosslinked or thermosetting polyurethanes of like hardnesses.

The thermoplastic polyurethane will reach an equilibrium moisture content of 0.6% at 50% relative humidity, but due to the completely reacted nature of the polymer, the water cannot form any hydroxyl isocyanate linkages and does not have any effect on the properties. If the polymer is exposed to humidity in excess of this amount, it will usually not have any effect as long as the recommended processing temperatures are observed. If porosity is noticed in molded parts or extrudates, it is usually an indication that stock temperature is excessive.

The thermoplastic polyurethanes are resistant to a wide variety of salt solutions, dilute acids and bases, and petroleum-based fuels, oils, and greases, but they swell and degrade in hot water, concentrated acids and bases, polar solvents, high concentrations of aromatics, and strong oxidizing agents (see Table II, below).

*B. F. Goodrich Chemical Co. Development Center, Avon Lake, Ohio

[1]A registered trademark of B. F. Goodrich Chemical Co.

Based on a paper presented at the SPE 17th Annual Technical Conference in Washington, Jan. 1961.

Compounding

Estane 5740X1 can be compounded in a Banbury or on a mill with a wide variety of fillers, pigments, lubricants, and certain plasticizers. In general, compounding conditions are similar to those used for polyvinyl chloride, although there is some difference in milling operations. Below optimum milling temperatures the polymer has considerable nerve, but shows only slightly more nerve than natural rubber at stock temperatures of 325 to 350° F. It exhibits thixotropic behavior on a mill and forms a progressively smoother sheet, but it will never become as smooth as polyvinyl chloride unless its temperature is raised to the point where it is likely to stick to the rolls. Since it will readily accept pigments and lubricants even

Table I: Physical properties of thermoplastic polyurethanes*

Property	*Estane 5740X1*	*Estane 5740X2*	*Estane 5740X7*
Specific gravity	1.20	1.20	1.20
Shore hardness			
"A" scale	88	70	96
"D" scale	35	23	49
Stress-strain properties (ASTM D 412)			
Tensile strength, p.s.i.	5840	5000	5840
300% modulus, p.s.i.	1240	420	2800
Ultimate elongation, %	540	720	490
Graves angle tear (ASTM D 625), lb./in.	430	250	700

*Estane 5740X1 is the general-purpose, medium-modulus polymer used for most extrusion, molding, and calendering applications. Estane 5740X2, the low-modulus variety, was developed primarily for solution applications. The harder high-modulus type, Estane 5740X7, is used chiefly in injection and compression molding.

Table II: Chemical resistance of Estane 5740X1

*Immersion chemical**	*Weight change*	*Tensile strength*	*Elongation at break*
	%	*p.s.i.*	%
None	—	5500	530
20% NaOH	−1.98	3300	580
20% H_2SO_4	+0.60	3800	590
Saturated NaCl	+0.76	3870	550
Distilled water	+1.05	3760	590
Automatic transmission oil	+0.26	4170	550
White gasoline	+2.62	4340	560

*28 days immersion at 23° C.

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When you want a production shortcut—or downtime and costs need cutting—there's a job for a Wood Press. And in almost every type of plastics or rubber operation, there's a Wood Press to do the job. R. D. Wood builds presses for such jobs as molding, curing, laminating, polishing and processing—besides designing and constructing others for special work. All have three things in common: sound design, carefully selected materials, conscientious workmanship. As a result, R. D. Wood Presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; trouble-free operation. Write for catalog and engineering information—without obligation.

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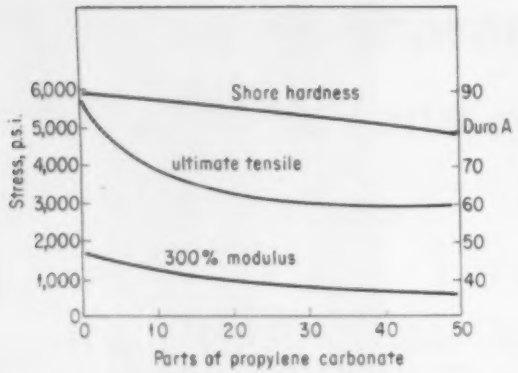


FIG. 1: Plasticizing effect of propylene carbonate on Estane 574OX1.

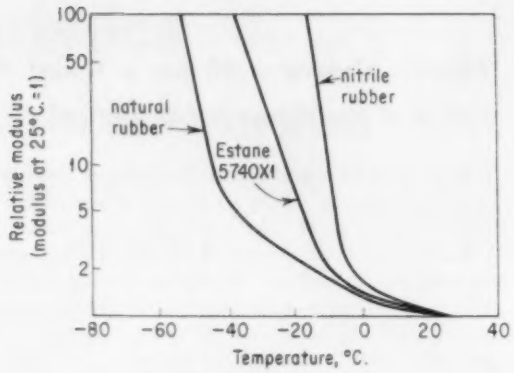


FIG. 2: Effect of temperature on torsional modulus.

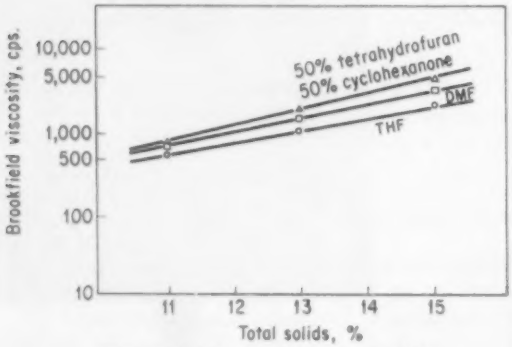


FIG. 3: Solubility of Estane 574OX1.

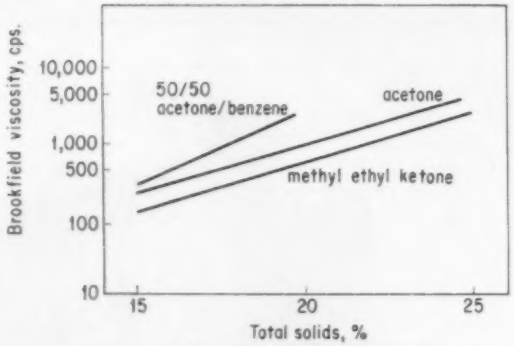


FIG. 4: Solubility of Estane 574OX2.

though the sheet is fairly rough, they should be added as soon as a continuous band is formed.

If sticking occurs because of excessive stock temperature, the temperature should be reduced as quickly as possible, but only for ease of milling since there is no danger of polymer degradation or crosslinking. A batch milled for 90 min. at 325 to 350° F. showed no change in physical properties. Opening the mill to reduce frictional heat build-up is usually a faster method of reducing stock temperature than reducing roll temperatures, although the latter will help. After some of the compounding ingredients have been added to the batch there is much less tendency for stock temperature to over-ride.

Milling is greatly simplified by the use of lubricants. Lubricants prevent sticking by reducing the

Table III: Extrusion conditions recommended for Estane 5801B Black

Temperature	
Stock	340 to 350° F.
Cylinder, rear	200° F.
Cylinder, front	300° F.
Head	325° F.
Die	350° F.
Screw	Neutral (no circulation of coolant)
Screw design	Most vinyl or PE types
Screw speeds	10 to 60 r.p.m.

Table IV: Molding conditions for thermoplastic polyurethanes

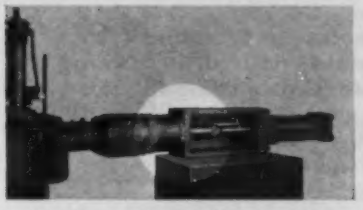
Molding conditions	*Estane 5740X1**	*Estane 5740X7**
Injection molding		
Stock temperature, °F.	350	360 to 375
Barrel temperatures		
Rear, °F.	250	270
Front, °F.	350	360
Nozzle temperature, °F.	350	360
Ram pressure, p.s.i.	20,000	20,000
Cycle time, sec.	30 to 90	30 to 90
Mold temperature, °F.	100	100
Mold shrinkage, in./in.	0.009	0.008
Compression molding		
Stock temperature, °F.	350	360
Mold temperature		
Initial, °F.	350	360
Final, °F.	100	100
Cycle time		
Preheat, min.	5	5
Mold hot, min.	5	5
Mold cold under pressure, min.	5	5
Pressure on stock, p.s.i.	500 to 1500	500 to 1500

*Lubricated with 1 part of barium stearate per 100 parts of resin.

PRODUCTO

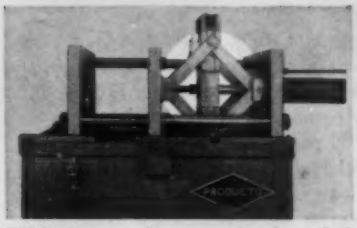
BLOW MOLDING BULLETIN

Hydraulic accumulator features variable back-pressure adjustment



In Producto Versa-Blow machines, accumulator ram is pushed back by plastic pressure, eliminating gas pockets, voids and degradation. Hydraulic pressure behind ram is adjustable to decrease extruder load while charging.

Positive equalized mold closing



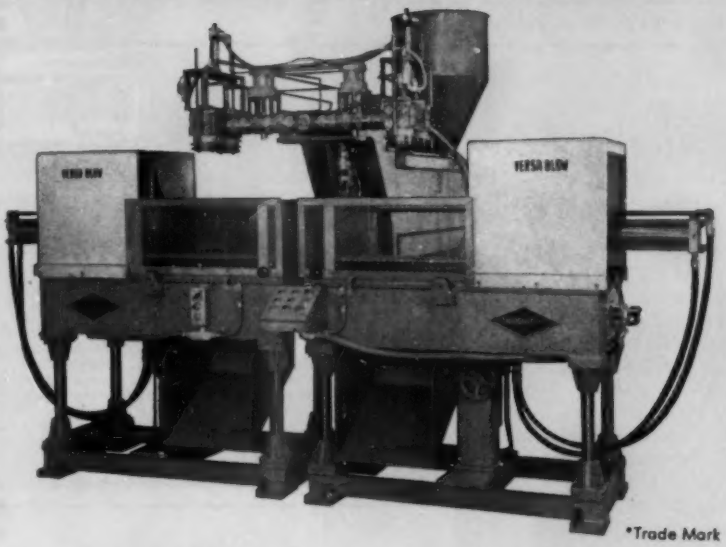
With the complete press load carried by a single hydraulic cylinder, double presses are close together and convenient to the operator. Scissor-type equalizer is *never under press load*, but guarantees positive simultaneous mold closing. Another important feature: Independent 3-way mold positioning on each press by adjusting screw.

Automatic quick-acting strippers

A built-in stripper assembly rapidly ejects parts to chutes without distortion as molds open.

All Producto blow molding machines have time delays which permit overlapping of all cycles for faster molding.

FOUR ONE-GALLON BOTTLES PER CYCLE WITH 2-STATION, 4-HEAD VERSA-BLOW*



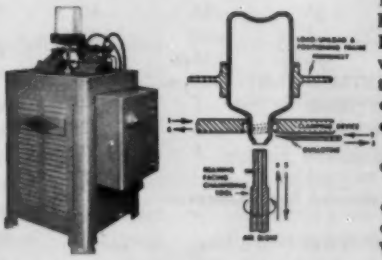
*Trade Mark

Producto's Versa-Blow series (Model VD-4, above) is ideally suited to high-speed production of gallon bottles when ordered with twin parison heads at both stations. Standard electrical equipment, including panel with twelve or more heat control zones, and complete automatic sequence control, choice of extruder, and complete hydraulics are part of this production-ready blow molding package.

Substitution of single parison heads permits molding of parts to 15" diameter by 30" long (20 gal. capacity).

STANDARD BOTTLE FINISHER—Chip-free bottle finishing in one second

Complete with automatic centering, locating clamp fixture, guillotine, and reaming unit.



The Producto Model BFM-2 Bottle Finisher is a high-speed partner to Producto's blow molding equipment, whenever bottle necks require finishing to length, reaming or chamfering.

- Construction is heavy.
- Precision engineering and quality components throughout.
- Compactly designed. Requires only 36"x30" floor space.
- Neck size capacity: up to 2".
- Height: 45". Weight: 600 lbs.

Write for all details.

Long a famous name in the metalworking industry, Producto is recognized as a leader in the design and manufacture of die sets, special machines, and toolroom equipment.

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PLASTICS MACHINERY DIVISION

THE PRODUCTO MACHINE COMPANY

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satisfactory processing temperature and by reducing frictional heat build-up. The raw polymers do not contain any lubricant, but most of the compounds supplied contain an effective lubrication system. Lubrication is recommended for all extrusion, molding, and calendering compounds. Lubrication will, of course, increase extrusion and calendering rates significantly, and is the most effective means of obtaining mold release.

Selection of the proper lubricant is most important since most of the waxes are so incompatible and difficult to incorporate that their use is not practical except for special applications. The metallic stearates are excellent lubricants for the polymer and can be added quickly and easily without even breaking the band on the mill. Barium stearate is regarded by many as one of the best general-purpose lubricants available, and, although it is ordinarily used at 1% concentration, it shows excellent compatibility and can be used at higher levels.

Carbon blacks have proven to be the most effective reinforcing agents, although they behave more like a filler than a reinforcing black in a rubber stock. The best protection for outdoor weathering has proved to be channel black which is an almost perfect barrier to the ultraviolet initiated weathering process. Certain titanium dioxides and ultraviolet absorbers are less effective, but are said to be quite satisfactory for light-colored exterior coatings.

The thermoplastic polyurethanes may be plasticized but, in general, the vinyl plasticizers, such as the phthalates, have limited compatibility and are difficult to add on a mill. Preferred plasticizers are propylene carbonate (1)[2] and Nevinol[3] A (2), which are easily incorporated. Fig. 1, p. 148, shows the plasticizing effect of up to 50 parts of propylene carbonate per 100 parts of the polyurethane. The ultimate elongation increases from 550% for the polymer to 770% at 50 parts of propylene carbonate per 100 parts of resin. In terms of plasticizing efficiency, propylene carbonate is approximately 60% as efficient in the polyurethane as dioctyl phthalate is in polyvinyl chloride.

Nevinol A is similar in its plasticizing effect but has a considerably lower compatibility limit of approximately 30 parts per 100 of polymer. Neither of these plasticizers has any significant effect on the low-temperature properties of the polymer.

Table V: Comparison of properties of thermoplastic polyurethanes and special-purpose rubbers

Property	*Estane 5740X1*	*Estane 5740X7*	*Nitrile compound*	*Polychloroprene compound*
Original properties				
Tensile strength, p.s.i.	5840	5840	2520	2500
300% modulus, p.s.i.	1240	2800	1820	—
Elongation at break, %	540	490	420	130
Hardness, Durometer A	88	96	69	85
Graves tear, C die (ASTM D 624), lb./in.	430	700	240	185
Low temperature brittleness point (ASTM D 746), °F.	−100	—	−36	−41
Compression set, 22 hr. at 158° F., %	87	—	11	12
NBS abrasion, % of control	180	225	—	82
Taber abrasion, mg. loss	3	3	44	146
Oil and fuel resistance				
ASTM #1 Oil, 70 hr. immersion at 212° F.				
Tensile change, %	−16	—	+7	−24
Hardness change, points	−6	—	−1	0
Volume change, %	−0.8	—	−0.4	+0.7
ASTM #3 Oil, 70 hr. immersion at 212° F.				
Tensile change, %	−2	—	−13	−44
Hardness change, points	−8	—	−9	−15
Volume change, %	+4.6	—	+17.0	+42.0
Fuel A, 70 hr. immersion at room temp.				
Tensile change, %	+14	−13.5	−11	−48
Hardness change, points	+1	0	−2	−7
Volume change, %	+0.7	+0.6	+2.0	+11.0
Fuel B, 70 hr. immersion at room temp.				
Tensile change,%	−19	−25	−63	−60
Hardness change, points	+1	−5	−14	−12
Volume change, %	+12.0	+6.0	+35.0	+41.0
Ozone resistance (ASTM D 1149)				
Initial cracking, hr.	none	none	1	24
General cracking, hr.	none	none	5	72
Total exposure, hr.	144	144	5	72
	no cracking	no cracking		
Stress-strain properties at elevated temperatures				
At 175° F.				
Tensile strength, p.s.i.	1950	3700	1500	1350
300% modulus, p.s.i.	450	1150	1100	—
Elongation at break, %	800	700	350	100
At 200° F.				
Tensile strength, p.s.i.	1050	2800	1150	1100
300% modulus, p.s.i.	450	980	1000	—
Elongation at break, %	800	730	320	110

Extrusion

Estane 574OX1 may be extruded on most plastic extruders with conditions very close to those used with vinyls. Satisfactory extrusion conditions (see Table III, p. 148) can usually be developed for most vinyl or polyethylene screws with compression ratios of 2:1 or 4:1. Compression developed by a decreasing depth of flight, rather than by a decreasing lead, has usually

[2]Numbers in parentheses designate references at end of article, p. 231.

[3]Tradename of the Neville Chemical Co.

Boxed in by present materials?

KRALASTIC Often design ideas are left on drawing boards due to the unavailability of proper materials. In fact, many companies have been unable to put advanced designs into production solely because of this condition. There is a solution, however, Kralastic® ABS resins.

Recommended for continuous use to 185°F, Kralastic retains its high impact strength even to —40°F, resists stress cracking from Freon, other chemicals, oils, and foods... will not warp or swell.

And Kralastic permits more advanced styling. Its long-term design strength allows for thinner walls. It can be easily injection molded, vacuum formed or deep drawn without damage to its surface or impairment of its physical properties. Moreover, Kralastic allows complete units to be molded, eliminating post-operational labor, assembly, and finishing costs.

Offering an amazing combination of strength and dimensional stability, Kralastic is available in all colors, colors that keep their rich luster indefinitely. For more information on Kralastic, write to Naugatuck Chemical, Elm Street, Naugatuck, Connecticut.

Naugatuck Chemical Division **United States Rubber**

Table VI: Refrigerant resistance

Immersion condition and property	*Estane 5740X1*	*Nitrile compound*	*Polychloroprene compound*
Original material			
Tensile strength, p.s.i.	6060	3350	2550
Immersed[a] in Freon 11			
Tensile strength, p.s.i.	4250	1950	1150
Tensile change, %	−30	−42	−57
Volume change, %	+5.2	+8.8	+15.6
Immersed[a] in Freon 12			
Tensile strength, p.s.i.	5950	2320	1550
Tensile change, %	−2	−31	−39
Volume change, %	+2.0	+4.4	+2.4

[a]Immersed 28 days at room temperature.

Table VII: Taber abrasion resistance of Estane-coated cotton[a]

Property	*Uncoated cloth control*	*25% 5740X1 in THF*	*25% 5740X2 in MEK*
Coating weight, oz./sq. yd.	—	2.6	4.2
First break in fabric, no. of cycles	1000	No breaks	5500
Appearance of holes in fabric, no. of cycles	1141	No holes	7000
Weight loss at 7000 cycles, g.	—	0.0661	0.3010
Weight loss at 10,000 cycles, g.	—	0.0957	—

[a]CS-17 wheel, 1000 g. weight.

been more satisfactory since a deep flight is more likely to deliver cold polymer to the discharge end of the screw. At processing temperatures below those recommended, the polyurethane is extremely tough and capable of overloading extruder drives. However, at optimum processing temperatures, polyurethane requires extremely little power and has melt characteristics more like those of polyethylene than of vinyl.

Table VIII: Thickening formulation

	Untreated solution	*Thickened solution*
Estane 5740X1	15	15
Tetrahydrofuran	85	42.5
Dimethyl formamide	—	42.5
Carbopol[a] 934	—	1.7
Di-2-ethyl-hexylamine	—	1.7
Water	—	4.25
	100	107.65
Brookfield viscosity, cp.	1,300	36,000
Yield value, dynes/cm.[2]	0	880

[a]Tradename of B. F. Goodrich Chemical Co.

Molding

Estane 574OX7 has a processing and molding temperature approximately 10 to 25° F. higher than 574OX1 (see Table IV, p. 148). Metallic stearate lubricants usually suffice as mold release agents. However, when molding unlubricated polymer, either a Teflon[4]-coated mold or a polyurethane mold release[5] will be required.

Special-purpose rubber replacement

The excellent oil, fuel, and ozone resistance of the polyurethanes is of particular interest in automotive and allied applications presently served by low-volume-swell, special-purpose rubbers. The cost savings that may be achieved in such applications by thermoplastic extrusion and injection-molding techniques is an important factor in enabling the thermoplastic polyurethane to compete with the less-expensive thermosetting materials. A comparison of their physical properties with those of two special-purpose rubbers is shown in Table V, p. 150.

The unusual degree of fuel and oil resistance of one of the thermoplastic urethanes may be illustrated by the comparison of its change in volume and physical properties with those of nitrile and polychloroprene rubbers (see Table V). It undergoes much less change than the special-purpose rubbers.

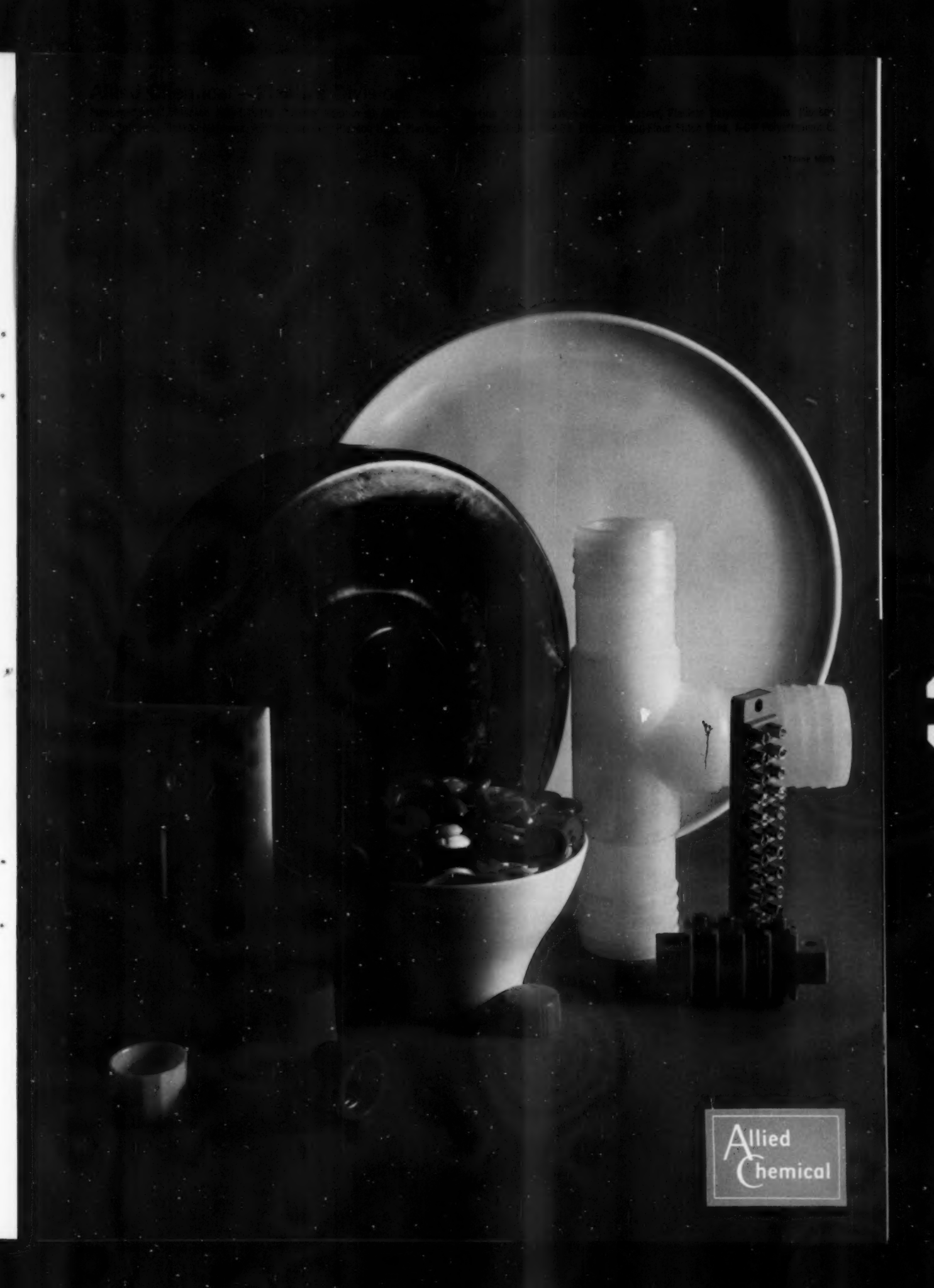
In the ozone-resistance comparison shown in Table V, the polyurethane showed no sign of ozone attack after a 144-hr. exposure, whereas its nearest competitor, polychloroprene, was affected within 24 hours.

In refrigerant service the polyurethane shows relatively little change after a 28-day immersion, as shown in Table VI, above. It should be noted when interpreting all of the immersion data presented that the polyurethane compound is the only one that **(To page 229)**

[4]Tradename of E. I. du Pont de Nemours and Co. Inc.
[5]UP-R3 Mold Release, North Shore Laboratories, Salem, Mass.

Table IX: Comparison of electrical properties of the thermoplastic polyurethane and an electrical grade PVC

Property	*Estane 5740X1*	*Flexible PVC*
Specific inductive capacity at 26° C. and 1000 cycles (ASTM D 150)	11.4	6.1
Dissipation factor at 26° C. and 1000 cycles (ASTM D 150), %	37.5	11.2
Dielectric strength (ASTM D 149), 1 kv./sec. rise, v./mil at 22° C.	550	700
Insulation resistance constant at 15.6° C. (ASTM D 470)	2.75	10,000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Allied Chemical — Plastics Division

PLASKON ALKYD AND ALKYD (DAP) MOLDING COMPOUNDS

Granular Type

Granular materials are designed for high-speed, fully automatic or semi-automatic molding operations. They include glass and mineral-filled grades. Contacts may be molded in or inserted in a separate procedure.

PROPERTIES

Provide high arc and insulation resistance and dielectric values which are maintained at elevated temperatures and after exposure to heat and humidity. Molded parts have unusually high dimensional stability (minimum after-shrinkage). This, plus the fact they are generally adaptable to rapid production cycles, permits endless reproduction of precision parts.

There are PLASKON Alkyd granular types that conform to the MIL-M-14F specification, Type MAG and, the poly diallyl phthalate type, MDG.

APPLICATIONS

Tube bases and sockets, connectors, tuning devices, transformer parts, potentiometer parts, motor controller parts, auto ignition parts, switch and relay parts.

Putty Type

For encapsulation of small electronic parts where delicate inserts are to be sealed within a protective shell. Molds rapidly at extremely low pressures. Available in soft, putty-like sheets. Easy to handle — no mixing required.

PROPERTIES

For many applications the coefficient of linear thermal expansion will be found similar to popular wire types (their thermal conductivity dissipates heat faster) producing less change in dielectric performance before and after encapsulation. Conform to the MIL-M-14F specification, Type MAG.

APPLICATIONS

Resistors, capacitors, coils, transformers, small electronic devices.

Impact Types

Reinforced with glass fiber for increased impact strength. Combines the electrical qualities typical of Alkyds with the high strength of glass fiber reinforcement. Also retains excellent dimensional stability characteristics of all Alkyd Molding Compound types. Suitable for compression and transfer molding.

Grades available to conform with the MIL-M-14F specification, Type MAI-30 and MAI-60; and MIL-M-19833, Type GDI-30.

APPLICATIONS

Computer parts, synchros, coil forms, terminal blocks, connectors, stand-off insulators, heavy-duty circuit breakers and switch gear.

PLASKON COATING RESINS

A complete line of alkyd, urea, melamine, styrenated alkyd, silicone alkyd, modified phenolic, maleic and ester gum resins for the surface coating and printing industries.

PROPERTIES

Each resin is designed to deliver specific performance characteristics such as gloss, superior gloss retention, chemical and solvent resistance, durability and rapid drying.

APPLICATIONS

Paints, varnishes, lacquers, printing inks and self-polishing floor waxes. Exterior and interior appliance, automotive and industrial uses.

PLASKON PHENOLIC RESINS

A family of outstanding thermosets. Properly applied, they result in strong, rigid, dimensionally stable products. A new pre-mix resin permits preparation of reinforced molding materials using the economical pre-mix method.

PROPERTIES

Unaffected by water, alcohol, oils, greases, mild acids and common solvents. Excellent heat resistance up to 700°F. when laminated with glass cloth. No marked change at freezing temperatures. Excellent electrical properties. Special grades offer extreme chemical resistance.

APPLICATIONS

Plaskon Phenolic Laminating Varnishes are widely used in decorative and electrical-grade laminates. New flame-retardant resins are available for switchgear and printed circuits. A special resin has been developed for aircraft and missile parts. Other uses include thermal insulation, battery separators, oil and air filters, shell molds and foundry cores.

PLASKON POLYESTER RESINS

A line of specially formulated resins for cost-saving pre-mix molding, which permit rapid production of parts of varying thicknesses, intricate contours or molded-in inserts. Molders can use their own reinforcements, fillers and catalysts.

PROPERTIES

Great strength and light weight in reinforced plastic laminates. "Built-in" molding advantages include pre-acceleration to speed production, rapid impregnation and excellent release for matched-metal molding. Plaskon Polyesters for matched-metal molding offer better mold release, higher gloss and less crazing than general-purpose resins.

APPLICATIONS

Boats, housings, translucent panels, furniture, packaging and aircraft components.

PLASKON HALON® RESINS TYPES VK & TVS

Fluorohalocarbon plastics for difficult design problems. Easily extruded, compression and injection molded. Structure retards crystallization during slow cooling cycles after exposure to high temperatures—tending to maintain toughness, flexibility and clarity.

PROPERTIES

Built-in flexibility, radiation resistance and excellent moldability. Virtually unaffected by inorganic acids, alkalies or oxidizing agents. No moisture absorption. Easy to clean. Excellent optical qualities. Transparent up to ⅛-inch cross section. Resistant to heat and cold: Type VK serviceable up to 350°F., TVS to 390°F. Thin sections can be flexed at −320°F. Good abrasion resistance, impact tensile and compressive strength. High volume and surface resistivity at high and low temperatures. Low dielectric constant and good power factor at high temperatures and frequencies. Nonflammable.

APPLICATIONS

Insulation for hook-up wire, printed circuit boards, flexible cable and cable assemblies. Coil forms, tube sockets, terminal insulators, etc. Lining material for storage tanks, pipe lining, gaskets, "O" rings, etc. Caps for containers of highly corrosive liquids.

PLASKON MELAMINE

A molding compound which provides the hardest surfaces attainable with plastics.

PROPERTIES

Excellent arc resistance, hardness, lightfastness. Inert to chemical and pharmaceutical reagents. Highly resistant to electrical tracking. Tasteless and odorless. Surpasses urea in resistance to acids, alkalies, heat and moisture absorption. Varying degrees of translucency permit unlimited color range.

APPLICATIONS

Dinnerware, appliance housings, electrical parts and wiring devices, cutlery handles and buttons.

PLASKON NYLON-6

New types of molding and extrusion compounds different from previously available domestic nylon. A polymer of caprolactam.

PROPERTIES

Unusual toughness, abrasion resistance, self-lubrication, high heat-distortion temperature, high strength-to-weight ratio and good chemical resistance. Less shrinkage and superior dimensional control than other nylon types. Broader melting range—can be molded at lower temperatures and pressures. Superior impact strength, better moldability in thick sections, easier pigmentation.

APPLICATIONS

Precision parts such as gears, cams and bearings. Small tubing, shapes, small and large rod, film, laminates, wire and rope covering. Parts requiring stability against oxidative embrittlement at high temperatures. Fish line, heel lifts, pipe fittings, pipe, blown bottles.

PLASKON UREA

A molding compound that comes in an extremely wide range of colors — pure white, pastels and brilliant hues. A special housing type has been developed for large parts fabrication.

PROPERTIES

Tasteless, odorless and inert. Resistant to grease, oil, solvents, heat, chipping and cracking. High dielectric strength and arc resistance. Excellent dimensional stability.

APPLICATIONS

Closures, wiring devices, stove and cabinet hardware, toilet seats, lighting fixtures, radio, appliance and other housings, cosmetic and jewelry containers, buttons.

*Trade Mark

Allied Chemical

BASIC TO AMERICA'S PROGRESS

Allied Chemical — Plastics Division

PLASKON FIRE-RESISTANT UREA UFR-28

A molding compound with low flame-spread rating, supplied in unpigmented natural color and a range of tint shades.

PROPERTIES

Self-supporting rigidity. UL flame-spread rating of 25 to 75. Meets fire-resistance requirements of municipal, state and national building codes.

APPLICATIONS

Lighting and appliances. Ideal for luminescent ceilings.

PLASKON WOOD-FLOUR FILLED UREA

An improved general-purpose molding compound available in black, NEMA closure browns and large-volume special opaque colors.

PROPERTIES

Tasteless and odorless. Highly resistant to electrical tracking; excellent arc resistance and insulation properties. Hard; lightfast; inert to chemical and pharmaceutical reagents. Often performs as well as cellulose-filled urea, differing mainly in opacity and color quality.

APPLICATIONS

Wiring devices, switch plates, closures, household circuit breakers and light industrial switch gear.

A-C® POLYETHYLENE 6

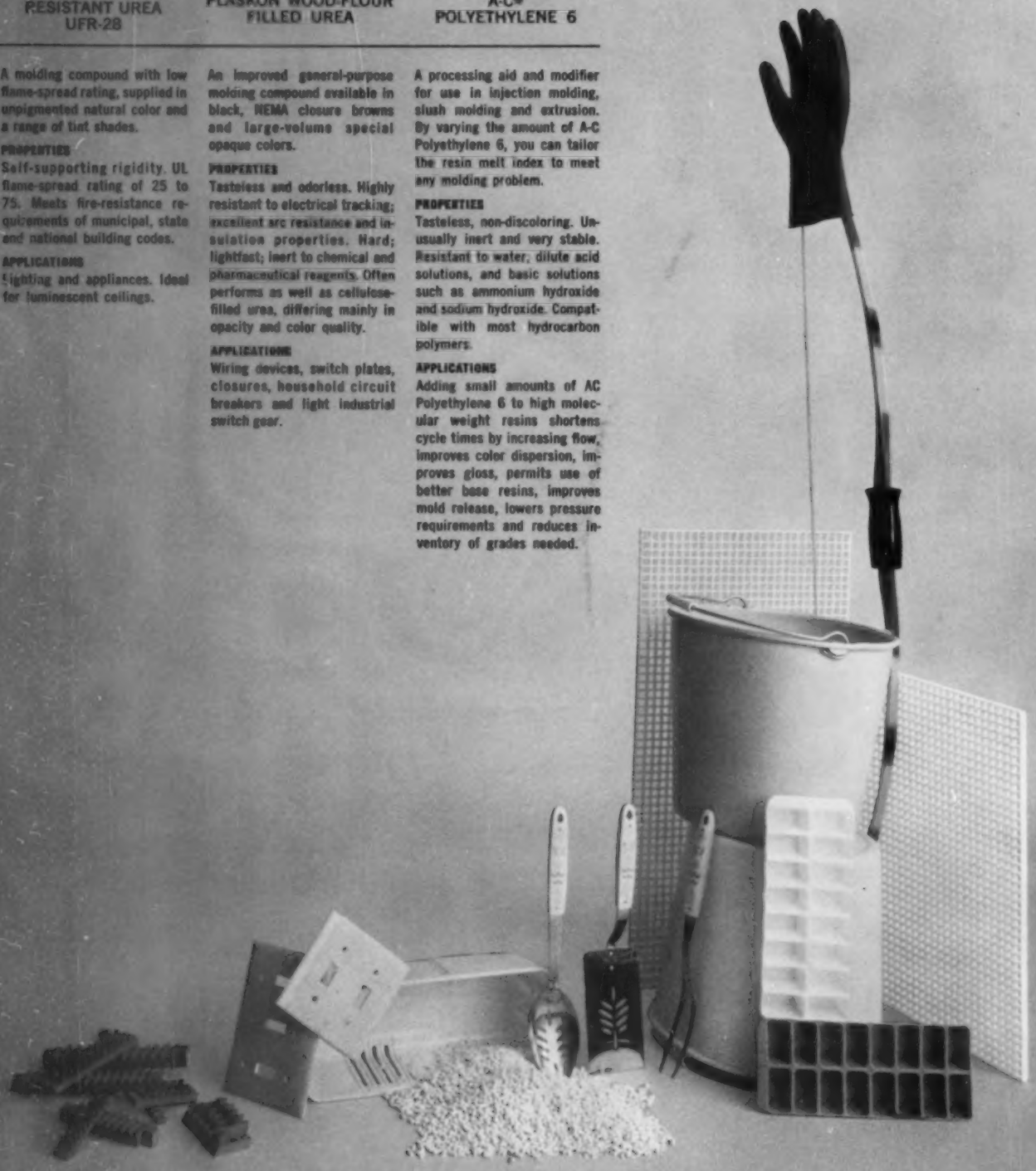
A processing aid and modifier for use in injection molding, slush molding and extrusion. By varying the amount of A-C Polyethylene 6, you can tailor the resin melt index to meet any molding problem.

PROPERTIES

Tasteless, non-discoloring. Unusually inert and very stable. Resistant to water, dilute acid solutions, and basic solutions such as ammonium hydroxide and sodium hydroxide. Compatible with most hydrocarbon polymers.

APPLICATIONS

Adding small amounts of AC Polyethylene 6 to high molecular weight resins shortens cycle times by increasing flow, improves color dispersion, improves gloss, permits use of better base resins, improves mold release, lowers pressure requirements and reduces inventory of grades needed.



Plaskon® plastics and resins are backed by the technical proficiency of Allied Chemical's applications and technical service laboratories. They are manufactured under the strictest quality controls. Write us for more information on any of these hard-working materials, or for help with design, fabrication or materials selection problems. 40 Rector Street, New York 6, N. Y.

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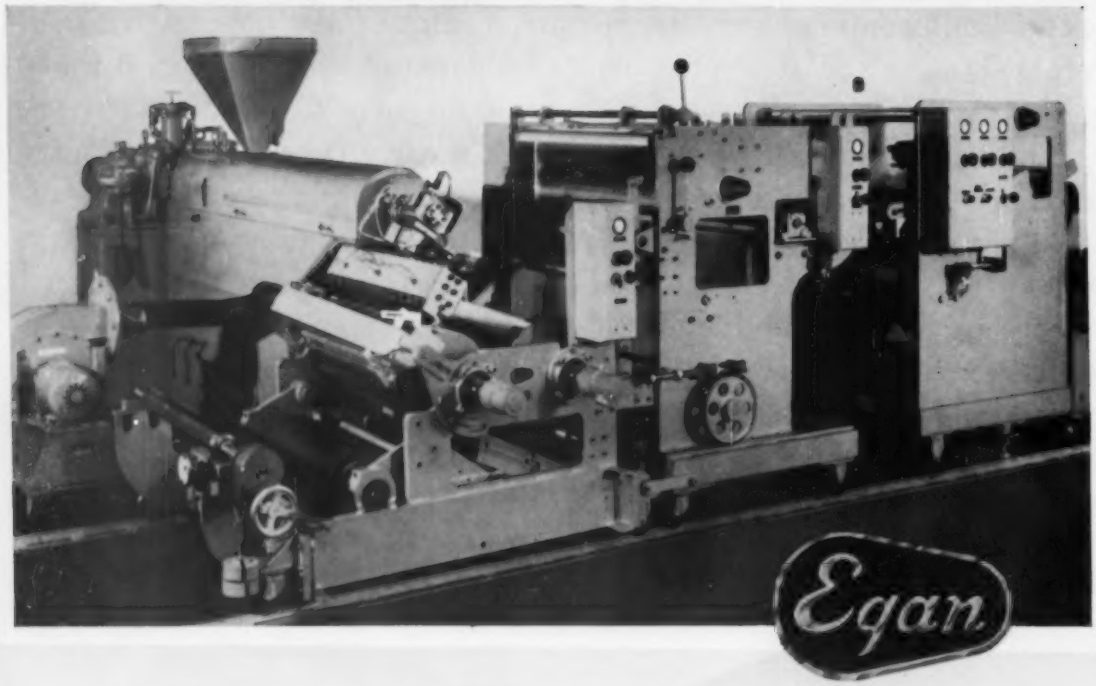
NOTICE: The information herein is presented in good faith, but no warranty is given, nor is freedom from any patent to be inferred.

Emil Berliner never read MODERN PLASTICS, but he played our overture, loud and clear. Emil, you might say, is the patron saint of disc jockeys, the man who pressed the first platter out of plastic. "Bakelite," they called it. It was a boon to many men in many ways, and it set off an early "boom!" in a market that's been busting out all over ever since. By the early Twenties, the industry was too big and too busy to keep track of itself . . . and there was MODERN PLASTICS, ready and able, to record its progress and keep tabs on technology. Today, the lusty infant is a 6½ billion lb. giant, grown 55 times its original size. There are at least 25 basic plastics, more than 50,000 formulations of a single plastic, a revolution in methods and machines... and still that same one, ready and able magazine. No, Emil Berliner didn't read MODERN PLASTICS, but today most of your best customers and prospects *do*, and overwhelmingly prefer it to other publications. **MODERN PLASTICS**

Authority of the field for thirty-five years — A BRESKIN PUBLICATION 770 Lexington Ave., New York, N. Y. OFFICES: Atlanta, Chicago, Cleveland, Los Angeles, Frankfurt, London, Tokyo.



THE MARK OF QUALITY

IN FILM EXTRUSION EQUIPMENT

Whether you are in the market for an extruder, a complete extrusion installation, or accessory equipment, Frank W. Egan & Company will meet your requirements.

Egan offers a complete line of extruders—direct electric heat, air cooled, or the highly advanced "Willert Temperature Control" model. All units are equipped with heavy duty thrust bearings, herringbone gear speed reducers, and many other superior operating and maintenance features to assure years of trouble-free operation at high output rates.

Egan Extruders are available in sizes from 2″ through 12″, vented or non-vented, with L/D ratios of 20:1, 24:1, 32:1.

The laboratory film extrusion installation pictured above features an Egan Air Cooled Extruder, as well as Egan accessory equipment. In an application such as this, excessive frictional heat is not too prevalent. Therefore, the temperature control system included on an Egan Air Cooled Extruder is sufficient to remove whatever excessive heat may develop.* The air cooling system is also helpful at time of "shut-down," since it is possible to cool the barrel more quickly. This minimizes the possibility of degrading any material remaining in the cylinder.

Installations, such as the one above, are suitable for cast film, water quenched film and extrusion coating.

Production size units are available with Egan Extruders from 2″ through 12″ and die and take-off equipment through 120″.

*Where excessive frictional heat is a problem, the Egan Extruder with the Willert Temperature Control System is recommended.

FRANK W. EGAN & COMPANY
SOMERVILLE, NEW JERSEY CABLE ADDRESS: EGANCO—SOMERVILLE NJER

MANUFACTURERS OF PLASTICS EXTRUDERS & ACCESSORIES, PROCESSING MACHINERY FOR PAPER, FILM & FOIL, AIR DRYING SYSTEMS; ROTOGRAVURE PRINTING PRESSES; TEXTILE FINISHING MACHINERY, METAL PROCESSING EQUIPMENT

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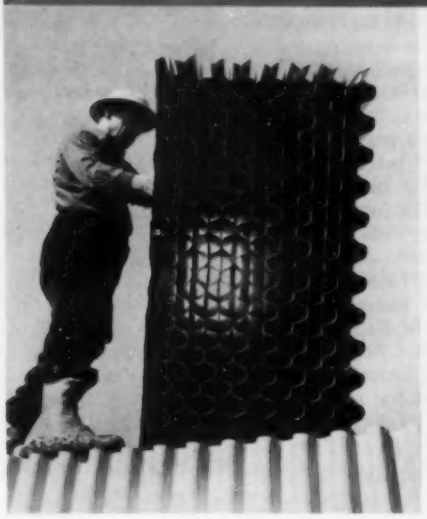
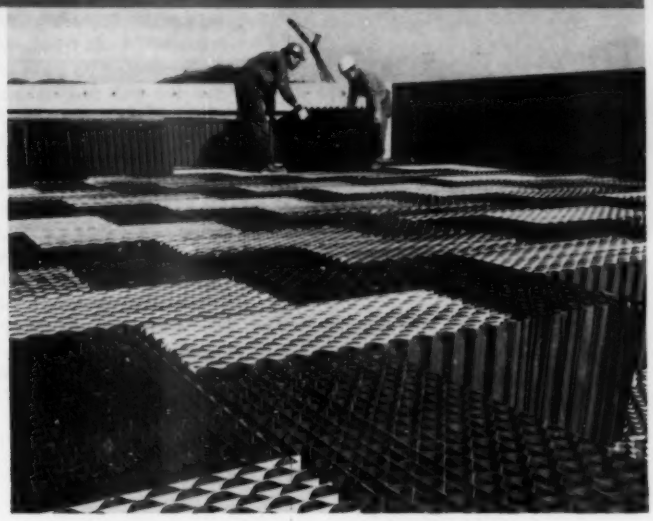
NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.



MODULAR sections for PVC filters measure 2 by 2 by 4 ft. each, are built up of 32 layers of calendered sheet, in alternating flat and corrugating pattern, heat sealed together.



LIGHT WEIGHT of PVC permits easy installation of modules in tall towers which save valuable industrial square footage. Material itself occupies only about 4% of filtration setup's total volume.

PVC sheeting for water treatment

About 370,000 lb. of rigid vinyl were used to construct a new trickling filter at the Rome Kraft Co. plant, Rome, Ga. Such filters are used for wastewater disposal by many food- and chemical-processing companies.

Traditionally, this problem has been tackled via rock and slag trickling filters. Now, by going to plastics structures, capacities have been increased and substantial savings realized. In the case of the Rome installation, the capacity increase was nearly 1000% and the savings a reported $500,000. The PVC trickling filter is made up of modules measuring 2 by 2 by 4 ft. each. In turn, each module is built up of 32 layers of calendered sheet arranged in an alternating flat and corrugated pattern. The individual sheets are bonded to each other by conventional heat-sealing technique.

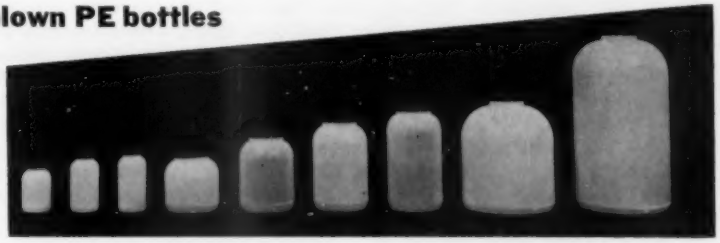
The surface area provided by this design comes to 40 sq. ft. for every cubic foot of filter. This offers ample room for growth of bacterial slime and also insures more rapid oxidation than is possible with rock-type filters. And the high degree of structural strength of the vinyl makes it possible to stack many modules on top of each other to keep the land area occupied by the filter to a minimum.

In the Rome installation, 6250 modules were assembled into a filter measuring 30 ft. high and 80 ft. across. Total volume is 100,000 cu. ft., which provides a treating capacity of 16 million gal. of water per day. The vinyl occupies 4% of total volume, leaving 96% free for air circulation, waste distribution, and bacterial growth.

Rigid vinyl sheeting and modules supplied by B. F. Goodrich Industrial Products Co., Akron, Ohio.

Wide-mouth openings in blown PE bottles

Featured in a new line of blow-molded polyethylene containers are bottles from 1 pt. to 5 gal. with mouth diameters ranging from 53 to 100 mm., heretofore difficult openings to produce. Mouth openings range from 28 to 38 mm. for conventional 1-pt. bottles.



The new container line is blow molded by Air Formed Products Corp., Nashua, N. H., a subsidiary of Bemis Bro. Bag Co. The wide-mouth bottles are primarily designed to facilitate knife or spoon dispensing of adhesives, chemicals, etc.

The wide-mouth bottles are produced from linear PE in clamp-type molds on a custom-built, continuously operating extrusion line. While the exact method of producing the unusually wide mouths is not divulged, it is known that they are made possible through use of an accumulator during the blow-molding operation. According to the manufacturer, neck areas on bottles tend to thin out during the blowing cycle if the accumulator is not used.

Quantity prices are 7¢ each for the 1-pt. bottles and $2.50 each for the 5-gal. bottles. They are available in natural, or in various colors by special order. **(More on p. 160)**

Embossed PS sheet for vacuum forming

Embossed polystyrene sheet for vacuum forming, already used commercially for the rear housing half of a new transistor radio, is expected to find further application in such products as luggage, TV cabinet backs, electrical and electronic equipment cases, appliance housings, and decorative building panels.

The material, newly added to the "Nylex" film and sheet line of Moulded Products (A'asia) Ltd., Melbourne, Australia, is claimed to be the world's first embossed PS sheet designed for vacuum forming. The sheet is flat-die extruded and post-embossed with a leather grain pattern in widths up to 48 in. in gages from 0.050 to 0.187 inches.

The high merchandising appeal afforded by the material led to its use in the "Town and Country" portable radio recently introduced by Philips Electrical Industries Ltd. Tests performed by the sheet supplier proved that the material could be vacuum formed into a radio case back having sharp corner radii with remarkably little distortion or loss of the leather pattern. And to further ensure retention of the pattern, a drape forming technique was selected by the vacuum former, Omicron Pty. Ltd., Melbourne.

The vacuum-formed back makes up half of the radio housing; the front of the case, incorporating the dials and control knobs, is injection molded of general purpose polystyrene. Red, charcoal, beige, and gray colors in the embossed sheet are specially compounded for the portable radio application by Monsanto Chemicals (Austral.) Ltd., which also supplies the PS resins.

First blow-molded housing produced in high-impact acrylic

Adaptability of high-impact acrylic to blow molding is evidenced by the recent introduction of a portable hair dryer featuring a housing blown from this material.

According to the manufacturer, Handy-Hannah Products Corp., Whitman, Mass., costs of blow molding the hair dryer housing are half what they would have been with injection molding. An injection-molded housing would have to be made in two parts, and, in addition, mold costs would be higher than those for blow molding.

The shell-like housing is blow molded by Plastica Inc., Milford, Conn., which uses an extruder and a two-station blowing machine with alternating platens. Differences in valve and crosshead design, not revealed by the blow molder, cause the housing to be produced in an asymmetrical shape. To provide for control panel fitment and motor installation, two holes, of 1 9/16 and 8 3/8 in. diam. are fly-cut in the housing's top and bottom, respectively. The resultant scrap is ground and reused.

After blow molding, the inner surface of the housing is coated with flame-retardant paint to conform with UL specifications. An air hose, made from clear, reinforced vinyl, is then fitted to the housing.

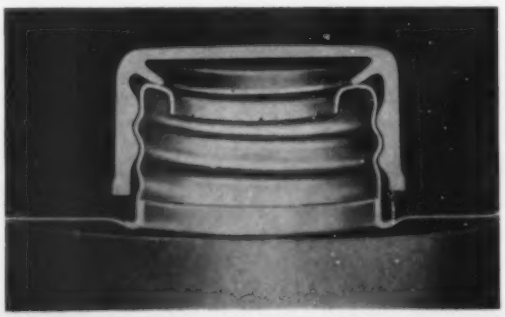
Material for the housing is natural Implex A, supplied by Rohm & Haas Co. The acrylic is dry-colored pink by the blow molder.

PE caps work better, cost less

High-density polyethylene linerless closures, developed by the Dover Molded Products Co., Dover, Ohio, have halted in-plant jamming of capping line machinery and ended a 5% rate of rework on bulk cartons that were contaminated from leakage.

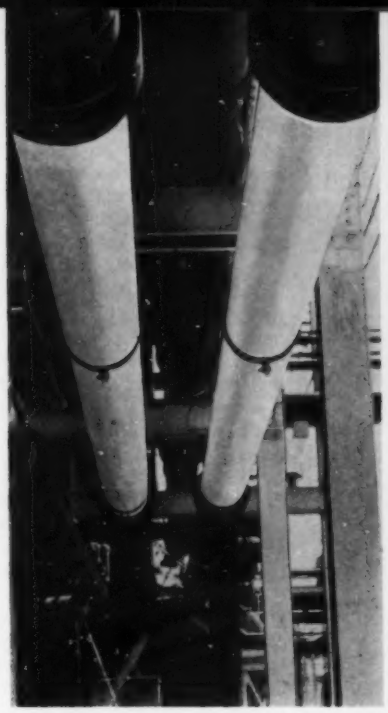
The new closure is being used by Merry Mfg. Co., Cincinnati, Ohio, as a twisting cap for a line of miniature toy replicas of brand-name bottled products.

These bottles are handled in bulk from conveyorized automatic filling, capping, and labeling lines, and packed 750 to a carton. With the formerly used thermoset cap, contents leakage from even a single bottle fouled many labels, made bottles sticky, and in most instances necessitated reworking of an entire carton. About 5% of all cartons had to be reworked. In addition, there was a 2 to 3% breakage of closures in the capping lines, requiring a total of 10 to 30 min. per day shutdown to remove cracked and broken pieces.



Both these problems—leakage and breakage—were solved by specifying high-density for the caps. The new caps work through the capping line at less critical tension settings. Capping heads grip the PE closures with pressures that would crack the more rigid caps, but cause no damage because of the resilience of the material. Polyethylene's resilience is also a factor in overcoming variations in bottle finishes. The new closures are even less costly on a unit basis than the thermoset caps that they replace.

Un-a-Tops are produced in multi-cavity molds in 13, 15, and 26-mm. sizes. Marlex high-density PE by Phillips Chemical Co.



PVF film in new pipe jacketing

A new jacketing material, consisting of an adhesive-bonded laminate of polyvinyl fluoride film, fibrous glass reinforcing strands, and aluminum foil, is designed to protect insulation on outdoor piping and ductwork from the effects of weathering for a minimum of 10 years. Conventional mastic coatings, by comparison, have a service life of approximately 1 year.

The jacketing laminate was developed by American Sisalkraft Co., Div. of St. Regis Paper Co. The company also produces the Pyro-Kure adhesive, a hot melt-type, with which the laminate constituents are bonded together. Since it is non-asphaltic, the adhesive has the permanent characteristic of releasing gas and becoming self-extinguishing in the presence of combustion temperatures.

The 1-mil PVF film is exposed to the atmosphere when the jacketing (approximately 7 mils) is applied over the pipe insulation. This film has excellent weatherability, dimensional stability, and resistance to flexural failure, retaining its flexibility at temperatures from 0° to 355° F. In addition, the film does not chalk or erode appreciably from exposure to sun and weather, and is highly resistant to staining and water vapor permeation, factors which promise low maintenance costs. Price of the new jacketing to pipe facing firms is 15¢ per square foot.

Initial markets are expected to be in refining, air conditioning, and similar fields where insulation on outdoor piping must be replaced frequently by the user.

Supplier of the Tedlar polyvinyl fluoride film is E. I. du Pont de Nemours & Co. Inc., Wilmington, Del.

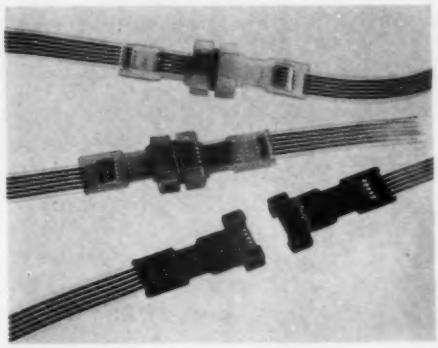
Nylon scores in electrical applications

Meeting the design requirements of the latest electrical trends, molded nylon plays an important role in two recent developments.

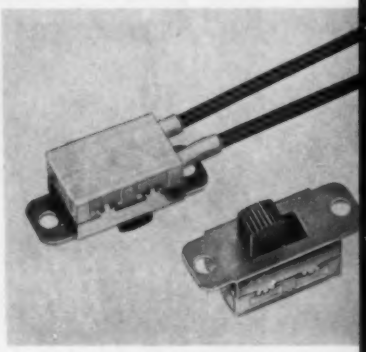
The first involves flat conductor cable that is finding increased use in house wiring, communication systems, automotive equipment, instrumentation, and similar applications. The insulation of this flat cable consists of polyester film, and nylon was chosen for the necessary connector units to balance the high dielectric strength of the insulation. Acceptance of dye after molding was another factor in specifying the material since it made color-coding possible. In addition to the connector, an adaptor for connecting flat cable to conventional cable is available in nylon.

In the second application, molded nylon is used as the base of a new low-cost 6-amp. slide switch for household appliances, power tools, and other electrical equipment. The switch consists of a nickel-plated case molded into a nylon base. Also molded into the base are individual barrier channels into which the switch terminals are recessed. This design lengthens creepage paths to prevent accidental contact between terminals. An optional molded nylon terminal cover is available.

Nylon (Zytel 101) supplied by Du Pont. Pos-E-Flex flat cable connector developed and made by The Thomas & Betts Co., Elizabeth, N. J. Slide switch components molded by Electronics Components Div., Stackpole Carbon Co., St. Marys, Pa.



CONNECTORS for flat cable are molded of nylon because of dielectric strength and acceptance of color-coding dyes.

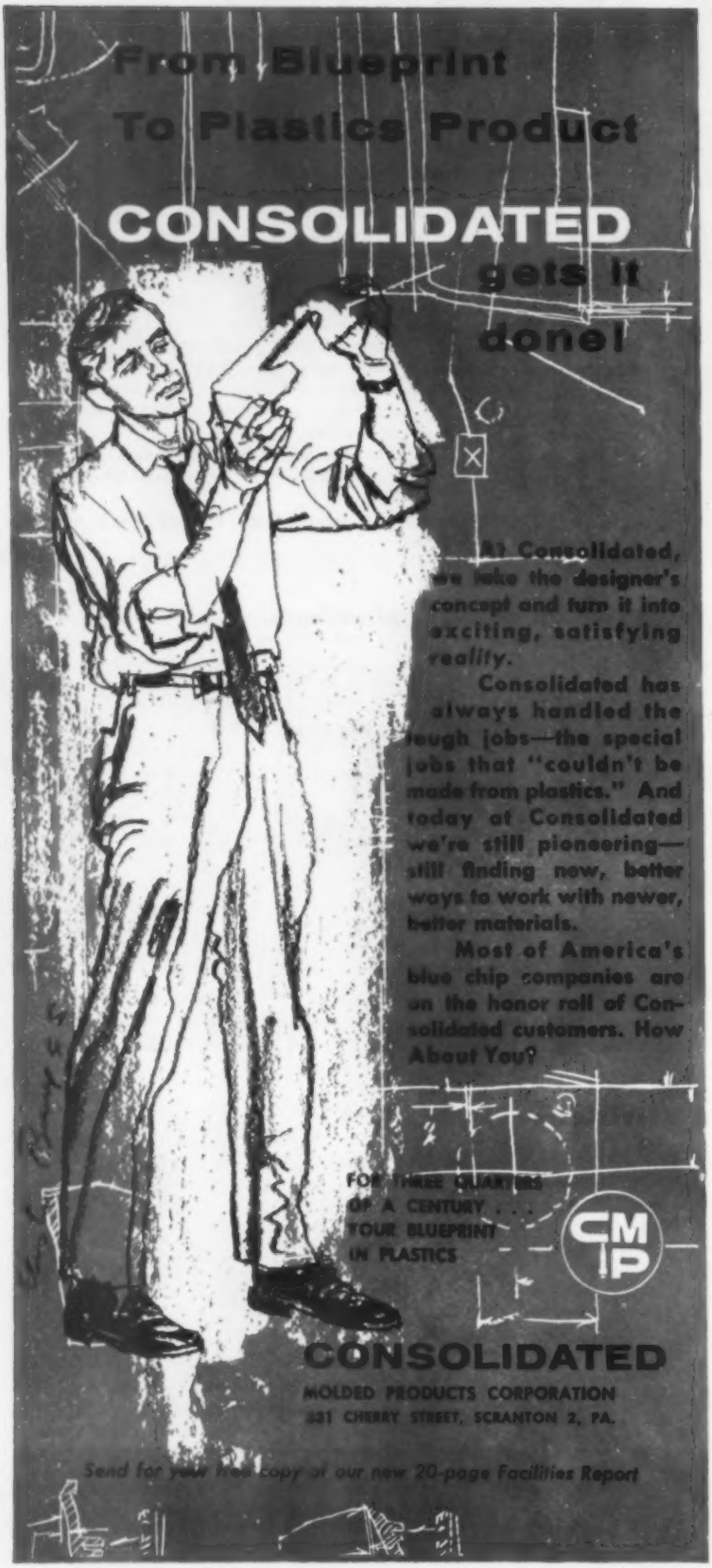


NYLON forms base of low-cost slide switch for appliances. Nickel-plated case is molded into base.

Phenolic for fogger

An attractively styled, jet black phenolic housing-handle adds merchandising appeal and functional utility to the new portable, electrically powered BVI Insect Fogger recently introduced by Burgess Vibrocrafters Inc., Grayslake, Ill. The assembled housing measures approximately 7 in. from front to back, 7 in. high, and weighs approximately 1.4 pounds.

Retailing for approximately $40, this device operates somewhat like a paint spray gun, but heater elements in the barrel react on the spray to produce 2000 cu. ft. of insect-killing fog per ounce of insecticide. Selection of phenolic (general-purpose, fast-curing) was based on the need for electrical insulating properties, dimensional stability to insure freedom from warping and an accurate assembly fit, and resistance to elevated temperatures developed in operation of the reciprocating type motor. The phe-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nolic material is also highly resistant to breakage and abrasion and is unaffected by contact with the oil-based sprays used for insect control.

The handle-housing consists of three parts: the mating right and left halves and the circular base, which is mechanically assembled to the main body of the unit. The housing halves, intricately ribbed and cored to provide mounting for the motor and other internal parts, are produced in a four-cavity mold running in a 350-ton compression press, using electronically heated preforms. The base, made in a six-cavity mold on a 200-ton press, is internally threaded on the bottom so that the glass insecticide container may be screwed to it. Threads are produced by manually removable cores. Assembly holes for the plastic parts are cored in the mold.

The trigger-type operating switch of the fogger and the adjustment knob which regulates the rate of liquid flow to the fogging barrel are molded of orange-colored nylon.

Phenolic components produced by Eclipse Mfg. Co., Lake Zurich, Ill., using Durez 791 and Plenco PE 512 general-purpose material. Switch and adjustment knob molded by L. T. Kinder Plastics Inc., Chicago, using Du Pont Zytel 101.

Polystyrene spyglass

Lightweight toy periscope for looking over crowds and around corners is now being produced in expandable polystyrene foam.

The periscope is molded in two halves which are joined together with rubber-base adhesive. Molded into the halves are grooves and recesses that accommodate two mirrors, a glass objective, and a glass eyepiece.

Units are molded for Product Development Co., Mendota, Minn., by Plas-tec Inc., St. Paul, Minn., from Dylite expandable polystyrene beads supplied by Koppers Co. Inc. Periscopes are sold in kit form or complete units for $1.98 each.—**End**

with Monsanto Polyethylene 70 extrusion coating resin ⇨

MONSANTO BRINGS OUT THE BEST IN PLASTICS

Because Monsanto Polyethylene 70 can be extruded at temperatures 25°-30° lower than competitive resins, you can protect inherent heat seal properties and have better control over extrusion odor development. MPE 70 offers excellent adhesion . . . reduces trim loss because of minimum neckdown . . . and MPE 70 has good draw down. Extended to 5 lbs/ream (less than 0.4 mil) coatings on cellophane maintain excellent uniformity, adhesion and heat seal properties.

Monsanto Polyethylene 70 offers a wide choice of package sealing temperatures and cycles because of its broad heat seal range. This range holds even after aging. And, if you are a food packaging coater, you can rely on Monsanto's rigid quality control specifications on resin odor. MPE 70 meets the FDA specifications for food contact use.

See the chart below for more data on MPE 70. For further information, write Monsanto Chemical Company, Plastics Division, Room 832, Springfield 2, Massachusetts.

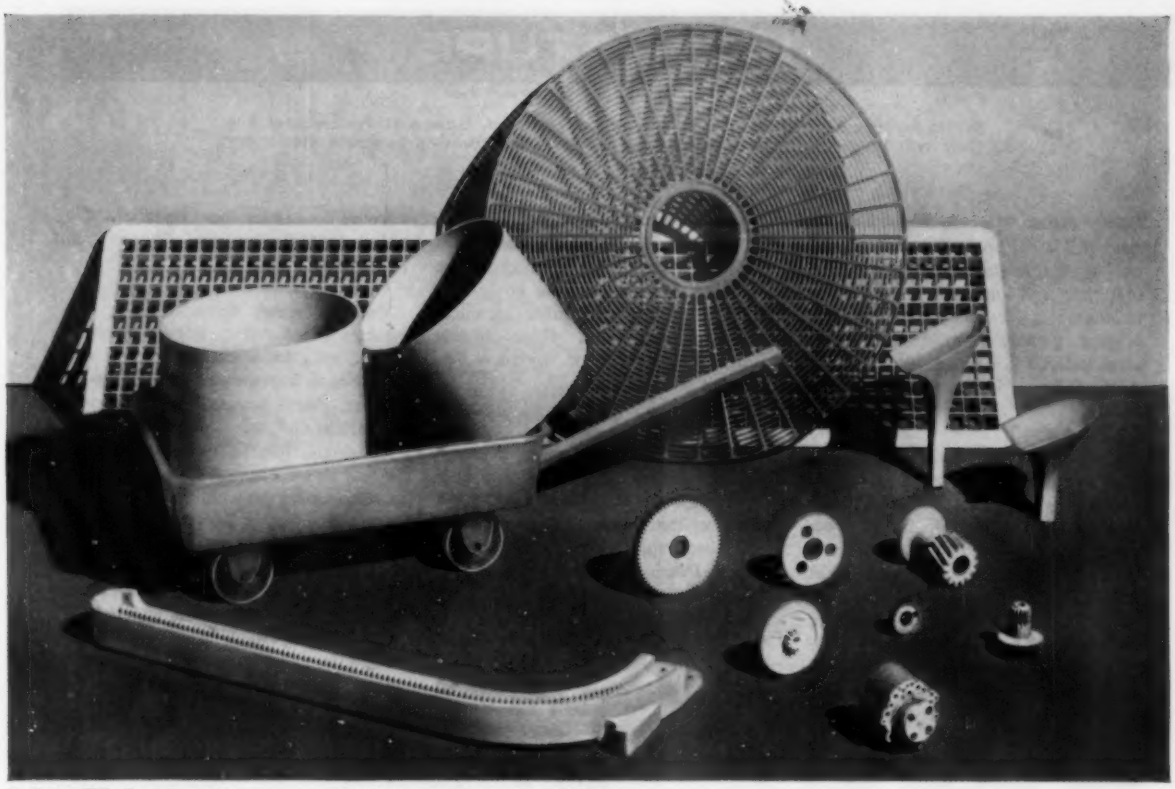
MPE 70 PERFORMANCE DATA

PROPERTY	TEST METHOD	UNITS	AVERAGE VALUES
BASIC Specific Gravity	ASTM D 792-50	---	0.918
THERMAL Melt Index	ASTM D1238-52T	gms/10 min.	5.0
PERMEABILITY (1 mil MPE 70/ 1 mil M Film) Moisture Vapor Transmission (100°F, 95% R.H.)	ASTM E 96-53T	gms./24 hrs./ 100 in. 2	1.45
PROCESSING Recommended Extrusion Coating Temperature Range		°F	560-600°F
Neck down @ 600°F, 24" Die, 4" die-nip			1¼" Total
Minimum Drawdown @ 600°F			5#/ream (0.35 mil)
24 hour adhesion on M cellophane			1300 gm/inch

Details of Monsanto Tests available upon request.

MONSANTO

Monsanto



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Max. Mold Size	12″ x 17″	15″ x 21″	15″ x 25″	20″ x 33″	27″ x 34″
Mold Locking Force (tons)	125	200	225	350	450
Mold Opens	5″-8″	6″-9″	8″-14½″	10″-20″	10″-20″
Dry Cycles (per hr.)	600-840	490-650	900-1050	600-800	600-800
Horsepower	15	20	30	40	40
KW Heater Unit	6	12	13	21	21½
Plasticizing lbs. per hr.	45	75	100	150	150

*Shot Capacities with Transfer Injector: Model 6-10-225 . . . 25 ozs.; Models 12-350 and 12-450 . . . 50 ozs.

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LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

Epoxy resins. "Oxiron Resins—a Series of New Epoxies" includes data on high-temperature properties of the material, and on their potential in laminate applications: wet lay-up, prepreg, printed circuitry, etc. Technical Bulletin 2. 8 pages. *Epoxy Dept., FMC Corp., 161 E. 42nd St., New York 17, N. Y.*

Silicone coatings. Brochure describes how Syl-Off silicone coatings impart nonsticking or release characteristics to a variety of package liners, processing papers, interleaving and slip sheets, etc. Includes samples. "Meet ASG Molding Compounds . . ." is another brochure, this one describing the company's new engineering service for providing technical assistance on fabricating parts with silicone molding compounds. 8 pages. *Dow Corning Corp., Midland, Mich.*

Polyvinyl alcohol resins. Physical properties; handling data; paper, adhesives, and textile applications; etc. for Vinol, fully hydrolyzed polyvinyl alcohols. Also includes properties for PVA film. 16 pages. *Air Reduction Chemical & Carbide Co., 150 E. 42nd St., New York 17, N. Y.*

Blow molding machines. Specifications, features, optional accessories, and other data for Versa-Blow single- and double-press blow molding machines. Eight different models available. 4 pages. *Plastics Machinery Division, The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn.*

Polycarbonate films. Properties, effects of moisture, suggested applications, effects of heat aging, permeability, chemical resistance, optical properties, and other technical data for Lexan polycarbonate films. 11 pages. *Chemical Materials Department, General Electric Co., 1 Plastics Ave., Pittsfield, Mass.*

Polypropylene fiber. "Monofilament Extrusion with Tenite Polypropylene" examines the physical properties of PP monofilament, and describes in detail the various steps involved in its production. Includes schematic diagrams of a typical monofilament extrusion unit and a monofilament die. Technical Report 6. *Eastman Chemical Products Inc., Plastics Div., Kingsport, Tenn.*

Dry colorants. "Dry Colourants for Polystyrene and Polyethylene" gives the advantages of dry coloring, choice of pigments, dry coloring equipment and techniques, and other technical data. *Erinoid Ltd., West Halkin House, West Halkin St., Belgrave Sq., London SW1, England.*

Research and development facilities. "Diamond Makes News in Plastics" outlines the company's technical center facilities at Painesville, Ohio; and discusses the variety of plastics resins and their applications available. 10 pages. *Diamond Alkali Co., Plastics Division, 99 Park Ave., New York 16, N. Y.*

Acids and anhydrides. Booklet describes properties and uses for acetic, propionic, butyric, 2-ethylbutyric, 2-ethylhexoic, acrylic, sorbic, valeric, and isodecanoic acids; and acetic, propionic, and butyric anhydrides, which have numerous uses in the plastics industry. 48 pages. *Union Carbide Chemicals Co., 270 Park Ave., New York 17, N. Y.*

Polystyrene. Mechanical, physical, optical, thermal, and electric properties for a line of general-purpose and modified impact grades of polystyrene. Bulletin S-61. 4 pages. *Solar Chemical Corp., Solar Park, Leominster, Mass.*

Processing chemicals. Bulletin lists types available, uses, etc., for such categories as: urethane cellular plastics, stabilizers, PVA emulsions, defoamers, resin and wax emulsions, water-soluble resins and lubricants, softeners, etc., which are vital ingredients for plastics, rubber, adhesives, paint, etc. 4 pages. Bulletin ISP-50. *Nopco Chemical Co., 60 Park Pl., Newark 1, N. J.*

Polypropylene film. Booklet provides information on the processing of cast Pro-fax PP film, and discusses properties, markets, processing data, and converting and packaging uses. Includes sample. 12 pages. *Hercules Powder Co., Hercules Tower, 910 Market St., Wilmington 99, Del.*

Plastics property charts. Physical, electrical, and chemical resistance properties are tabulated in detail for butyrate, ABS, nylon, chlorinated polyethyl, PE, PP, polystyrene, vinyl elastomers, and PVC. Listings take from 2-4 pages per material. *The Conneaut Rubber and Plastics Co., Conneaut, Ohio.*

Variable speed drive. Catalog discusses the features, prices, specifications, etc., for a line of integral and fractional horsepower variable speed drives. Some integral and fractional modifications are illustrated, including single, double, and triple reductions; and horizontal and single- and double-worm assemblies. 112 pages. *Sterling Electric Motors Inc., 5401 Telegraph Rd., Los Angeles 22, Calif.*

Extruders and accessories. Descriptions, specifications, and suggested applications for a line of twin-screw extruders and accessory equipment. The machines are designed primarily for rigid PVC, but are said to be usable with other thermoplastics as well. Among the accessories are granulator unit, heads for pipe extrusion, and pipe sizers and coolers. 26 pages. In English. *Anger Plastic Maschinen GMBH & Co., Leopoldstrasse 18, Munich 23, Germany.*

Plasticizers in Protective Coatings. Booklet describes the plasticizing of resin coatings, and contains over 150 suggested starting formulations for 19 different types of cellulosic, vinyl, rubber, and other resin coatings. Includes 10 tables of comparative evaluations of plasticizers in as many different coating systems. 56 pages. *Monsanto Chemical Co., 800 N. Lindbergh Blvd., St. Louis 66, Mo.*

Plastics signs. "Plexiglas Handbook for Sign Shops" contains detailed information on the construction of acrylic signs. Illustrated with photographs and diagrams, the handbook includes various new construction techniques, and gives technical information on the design, fabrication, decoration, lighting, and assembly of signs. 92 pages. *Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Fire-retardant materials. Booklet discusses, via charts and text, the company's line of Durez thermosetting molding compounds; Hetron fire-retardant resins for reinforced plastics; bonding and coating resins; and Hetrofoam fire-retardant rigid foams. 8 pages. *Durez Plastics Div., Hooker Chemical Corp., 8 Walck Rd., North Tonawanda, N. Y.*—**End**

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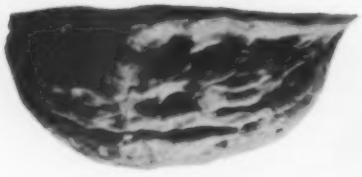

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Urethane foams

(From pp. 82-86)

a problem for more conventional materials.

In general, spray-up uses very-fast-reacting foams (to prevent sagging or dripping from vertical surfaces), supplied in two-component systems that are stored separately and fed in separate streams to the guns. The specially designed guns themselves are of two types: 1) internal mixing guns which mix the foam components either mechanically or with compressed air inside the gun and carry the mixture to the application surface by atomizing air; and 2) external mixing guns which mix the components outside the gun with the atomizing air which also carries the material to the surface to be sprayed. More recently, "airless" spray techniques have been used in which the foam system is applied by an internal-mix gun with the atomizing cap removed. The foam emerges from the nozzle as a high-velocity stream of about ⅛- to ¼-in. diam., expanding at virtually the time of impact with the surface to be coated or the cavity to be filled.

Almost any surface area can be sprayed to thicknesses to ¼ to 6 in. (the foam will adhere to most anything, except polyethylene, polypropylene, fluorocarbon, stainless steel, or untreated aluminum). The rigid foam is self-supporting within minutes after spraying. It will attain nearly maximum physical properties after several hours at room temperatures and top strength is reached after 24 hours.

Frothing: This newest of application methods (developed by Du Pont) involves the use of special techniques to introduce blowing agents or tiny air bubbles under pressure into the liquid mixture of foam ingredients. The effect is to expand the mixture before the start of chemical reactions which gel the foam. Final expansion is thus on the order of three- to six-fold; with conventional techniques, the foam mixture expands 30 to 40 times to reach final volume.

The lower-density froths are similar in appearance and consistency to aerosol-dispensed shaving cream. They can be poured, knifed smooth, or otherwise processed without causing collapse. Because expansion is so much less, exotherm and pressure are reduced and the need for jigs to hold the piece to dimensions is not as critical. The technique is also said to offer reduced foam-in-place densities since it eliminates the high-density skin that appears adjacent to the surface of the cavity when conventional techniques are used. Thermal insulation characteristics and uniformity of foam are also claimed to be improved.

To date, use of the technique has been held back by lack of equipment, which has only been made commercially available in the last few months. (A typical unit for dispensing froth at the rate of about 25 lb./min. can be had for about $6000.)

Rigid slab stock: While the excitement is all in the three techniques described above, the less-publicized rigid slab stock continues to plod steadily ahead. Currently selling for 16½ to 30¢/bd. ft., slab can be cut, fabricated, and applied with conventional techniques.

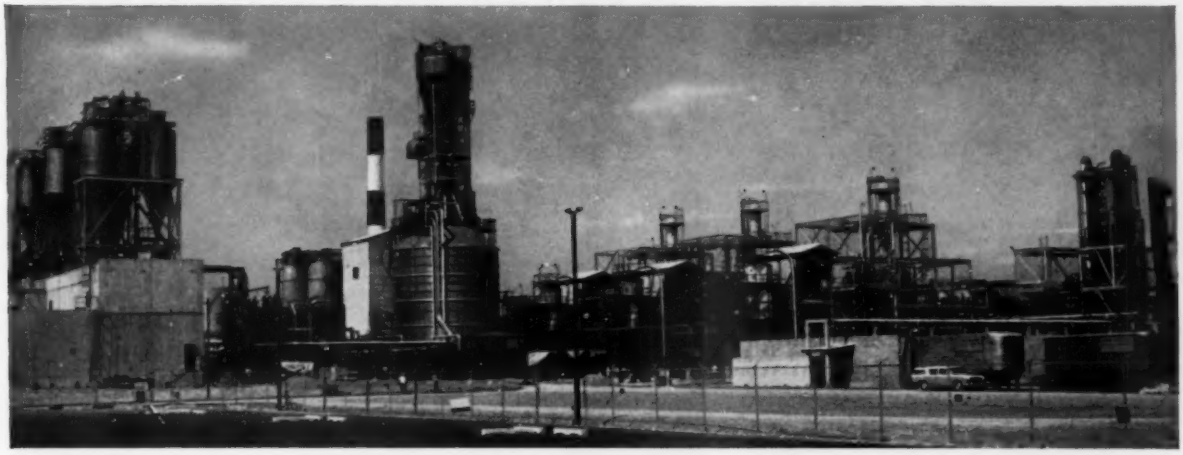
Major end-use areas for rigid slab are as insulation for refrigerators, transportation, pipe, and curtain-wall panel cores, and other forms of construction. Barrett Div., Allied Chemical, a supplier of rigid slab, sets the potential for rigid board insulation at about 635 million bd. ft.; low-temperature space insulation might account for 200 million bd. ft. of this figure, roof insulation would account for another 200 million, and pipe and vessel insulation, perimeter and floor slab insulation, cavity wall and plaster board insulation, backerboard and metal sidings, floating structures, and non-residential panels would divide up the rest.

In light of the economies inherent in foaming, spraying, or frothing (see below), rigid board has a job cut out for itself in keeping its share of the market. How successful it will be at that will depend on the extent to which the newer techniques can iron out some of the problems they now present to end-users. Size of the application too will be a factor. As user's volume increases, *e.g.*, as is happening with household refrigerators, foaming techniques present the more favorable cost and production picture.

When one considers that foaming, spraying, or frothing can be accomplished in one **(To page 174)**

AVISUN

announces world's biggest polypropylene plant now in production



100 million lb/yr capacity assures ample supplies of polypropylene for the fast-growing number of users

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COMPARISON

Properties	ASTM	Oleform	Acetal	Nylon 66	Wood Flour Filled Phenolic
Mechanical[a]					
Tensile Yield Strength[b], 10^3 psi	D638	4.5	9.8	8.5-9	7.5
Elongation at Yield[b], %	D638	6	10	60	1
Tensile Modulus[c], 10^5 psi	D638	2.9	3.75	1.75	10
Flexural Modulus[d], 10^5 psi	D790	5.5	4.1	1.75	10
Izod Impact Strength, ft-lb/in notch	D256	0.9	1.4	2.0	0.3
Physical					
Specific Gravity	D792	1.24	1.43	1.14	1.45
Heat Distortion Temp., °F	D648				
at 66 psi		295	338	360-390	300
at 264 psi		205	212	150-170	275
Water absorption (24 hr.) %	D570	0.02	0.12	1.5	0.6
Lin. Coef. of Ther. Exp., 10-5 in/in/°C	D696	3.8	8.1	10	3.8
Chemical Resistance					
Acids		Excellent	Attacked	Attacked	Good
Bases		Excellent	Attacked	Excellent	Attacked
Solvents		Good	Excellent	Good	Good
COST					
Cents/lb		36	65	98	22
Cents/cu in		1.5	3.3	4.0	1.2

[a] Injection molded specimens at room temperature
[b] Crosshead speed 1/min
[c] Crosshead speed 0.2/min
[d] Crosshead speed 0.05/min

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In an important advance stemming from extensive research, AviSun introduces the first high molecular weight polypropylene pipe grade resin combining low cost with excellent properties. It has been broadly tested with highly satisfactory results. AviSun pipe grade resin can be processed in most conventional plastic extruders—at rates equal to or greater than that of linear polyethylene. Its high per-pound yield makes it one of the most economical plastics.

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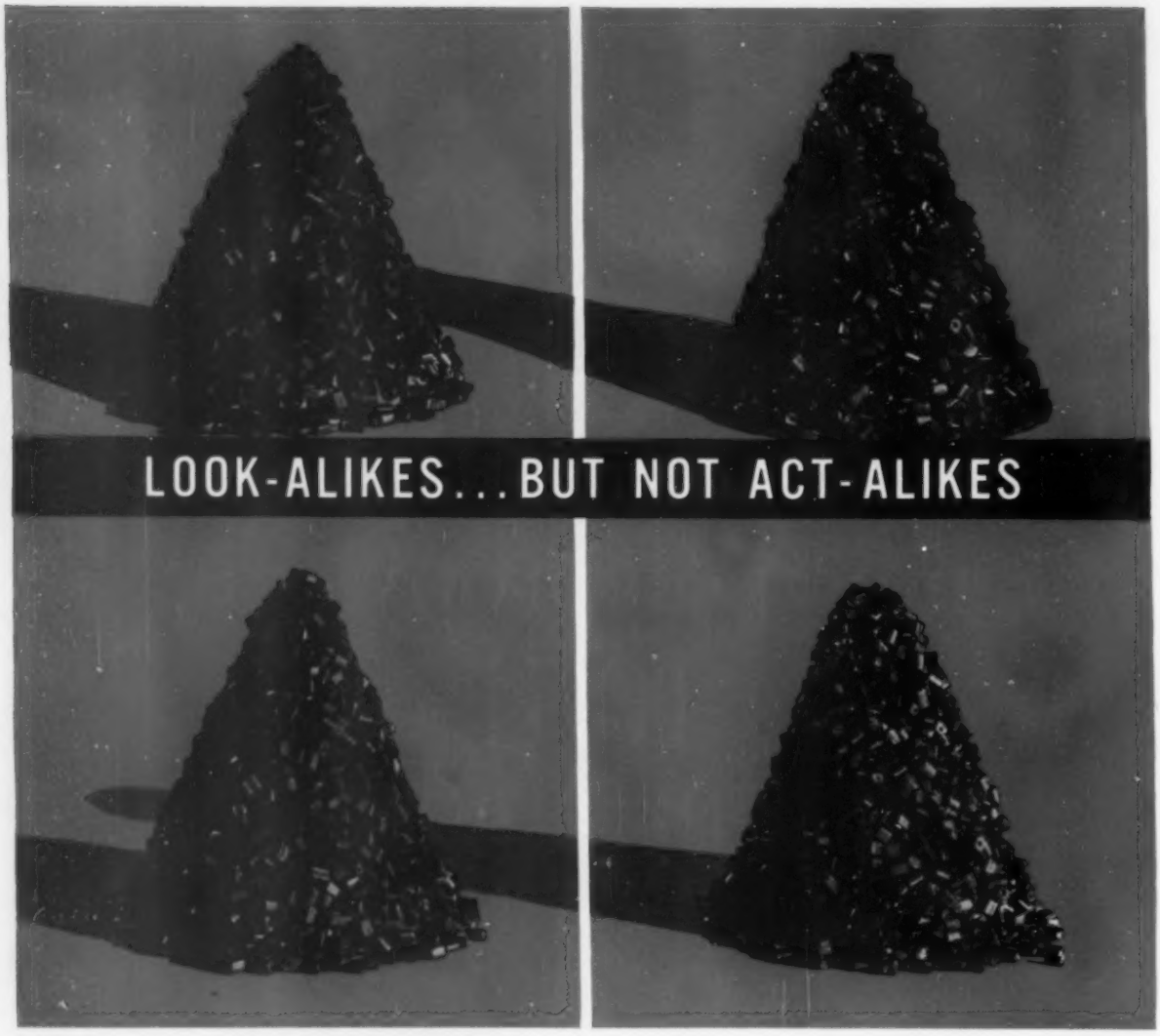

AVISUN announces four new impact grades of polypropylene

Here, for the first time, are new impact grades of polypropylene—all possessing a translucent white resin color—with flow rates suitable not only for injection molding, but also for sheet extrusion, vacuum forming and blow molding. All four retain desirable properties characteristic of general purpose polypropylene—lightness, low cost, high heat and chemical resistance. *But each grade offers a step-up in impact strength at room temperatures.* Equally important, most of this strength is retained at lower temperatures—in the case of High Impact Grade 3210, as low as 10°F.

AviSun technical specialists can help if you plan to use a new AviSun impact grade of polypropylene for *your* product. For full technical data or counsel, write to us.

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Property	Impact Grade 3116	Impact Grade 3216	High Impact Grade 3211	High Impact Grade 3210
Izod Impact Notched—ft-lb/in Unnotched	1.5 over 16	2.0 over 16	10 over 16	15 over 16
Flow rate—gm/10 min (nominal)	5.0	5.0	0.7	0.5
Type of molding	injection	injection	sheet extrusion vacuum forming	blow

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simple operation, the economies inherent in eliminating the cutting, shaping, laying, and gluing involved with solid forms of more conventional materials (*e.g.*, fibrous glass batts, expanded polystyrene board, cork, etc.) is obvious. Here's the type of case study that the industry can tell you about:

Two 500,000-gal. caustic storage tanks (see photo, p. 85) can be insulated with a sprayed-on foam at an application cost approximately two-thirds that of a comparable job using fibrous glass as the insulating medium. . . . The pour that forms the core of a lightweight cold storage door with metal skins can be completed by 2 men in only 20 min., as compared to the 2 hr. previously required with use of rigid board. . . . A chemical storage tank, 12 by 5 by 5 ft., can be lined with 300 lb. of foamed-in-place urethane (1-ft. thick) in only 45 min.; previously, lining with cork insulation required upwards of 8 hours.

But these obvious cost savings are not the whole story for rigid urethane foams. Their versatility in application opens up whole new vistas in design innovation.

The experimental work being done by the Quartermaster Research and Engineering Command at Natick, Mass., on foamed-on-site shelters (urethane sprayed on the outside of an air-inflated form) is one such example. And how's this for another exciting approach to the same concept: building shelters by allowing the rigid foam to expand and fill between pre-shaped *flexible* skins. In one such system, skin containers would be made with the foam components inside but separated in easily breakable bags. The collapsed shelter shape would be hauled to a site, where the bags containing the foam components would be broken, allowing the foam to expand inside the skins to form the complete shelter—interior and exterior walls and roof—in only a matter of a few minutes.

Spray-up techniques also play a role in a unique approach to boat building. The idea, aimed at the markets for larger reinforced plastics boats, is to build up a hull from long planks of corrugated reinforced plastics panels cemented to transverse bulkheads and then fill the channels of the planks with spray-on rigid foam. The surface of the foam is then smoothed down and an outer laminate skin applied. Installation is fast—an operator reportedly can spray up a 55-ft. yacht in a single day.

And keep your eyes on pour-in-place techniques for other than conventional insulating applications. The packaging industry, for one, has expressed more than passing interest in Royal McBee's use of the idea for shipping typewriters illustrated on p. 82.

And here's another unusual solution to a design problem effected with pour-in place urethanes. The manufacturer in question: Aero Service Corp., Philadelphia, Pa.; the problem: to impart adequate rigidity to a line of relief maps without adding weight. The solution: rigid urethane poured-in-place over the epoxy backing of the maps. To minimize shrinkage, the company decided to support the maps with prefoamed urethane blocks fusing them to the epoxy backing material by setting them in a layer of "working" foam spread on the backing. A simple plywood and metal frame and pressure from a platen above confines the foaming action and controls density. The foamed area is then trimmed and leveled and an epoxy-glass laminate is placed over the core. Result: a stable, lightweight "sandwich-type" construction strong enough to support the weight of an adult.

Some disadvantages, too

Life, however, is not all beer and skittles for the rigid urethane foams.

As far as foaming, spraying, or frothing are concerned, it must be remembered that all three techniques are still new and still weak in methodology and materials formulation. And end-users should approach them with caution. When foaming-in-place, attaining uniformity and controlling pressures are critical. Similarly, spray-up requires close control and skilled application to avoid unevenness, ripples, or overspray. Frothing is still under evaluation.

None of these problems, however, are in any way insurmountable. End-users should simply remember that foaming techniques are still new and that handling them requires skill and knowledge.

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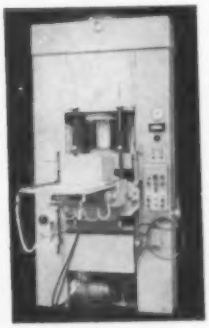

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Minneapolis-Honeywell Regulator Co. Fall River, Mass.
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Molding Corp. of America, Pawtucket, R. I.
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Northwest Plastics, Inc., St. Paul, Minn.
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Perry Plastics, Inc., Erie, Pa.
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Pure Carbon Co., Inc., St. Marys, Pa.
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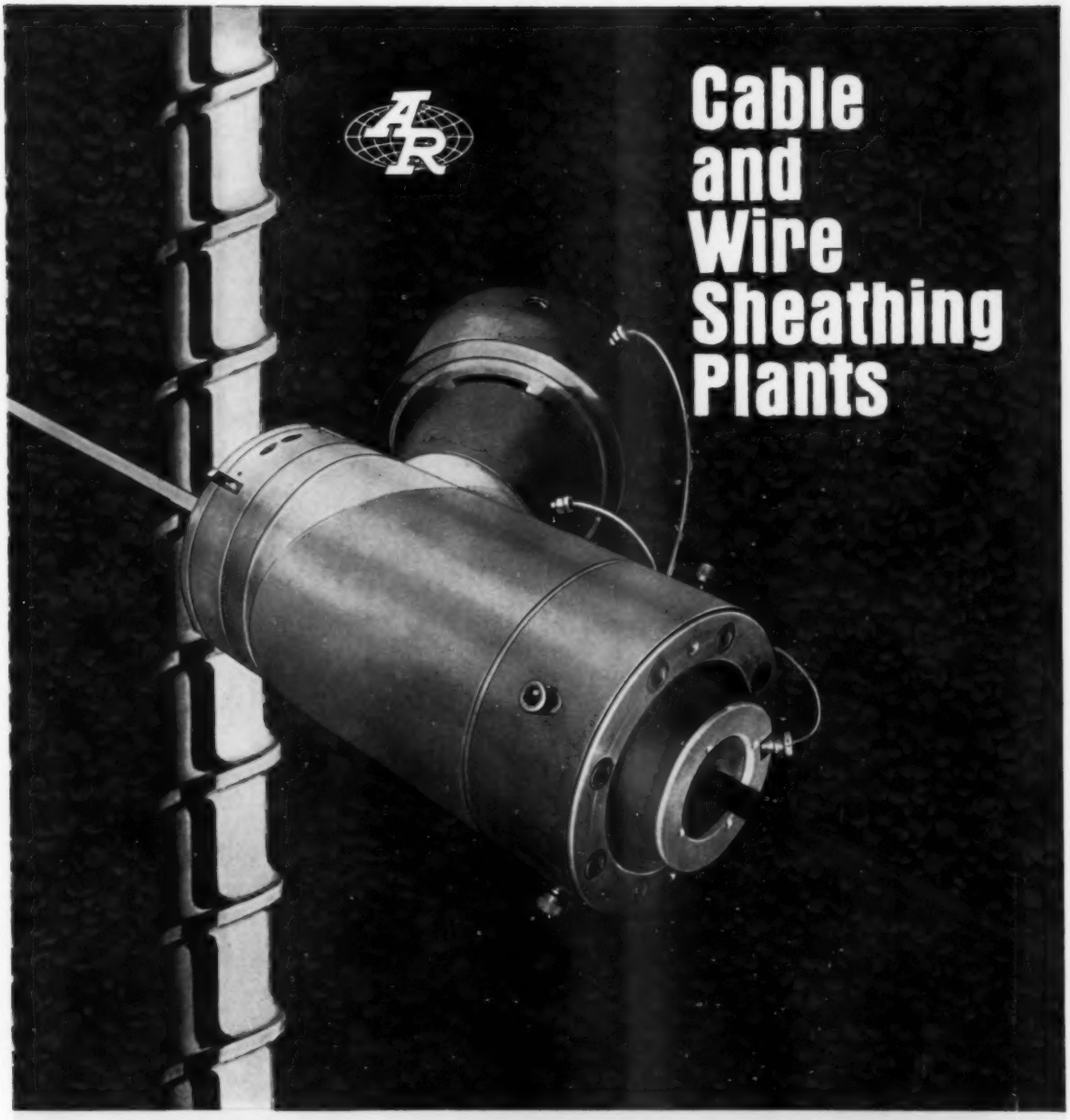
ered with the spray materials is the fact that toxic toluene diisocyanate vapors are released during the reaction of the foams and it is essential that protective forced-air-type masks, as well as other safety equipment, be used.

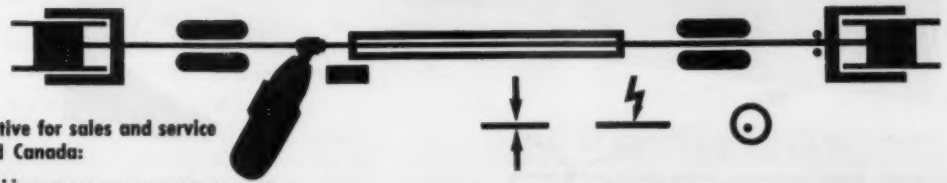
To date, there has been much comment about the need for better flame resistance in urethane foams —particularly as it affects their future in construction markets. A number of self-extinguishing and even non-burning foams, however, are just coming out of the laboratory stage based on chemical fire retardants built into the polymer—instead of on inert fire-retardant plasticizers and fillers which could possibly affect physical properties and have a tendency to migrate. Two manufacturers of curtain-wall panels are currently using flame-resistant polyester urethane foams based on Hooker's HET resins (see MPI, June 1961, p. 86); the foam sprayed on as insulation in the two houses in Pittsburgh (see photo, p. 85) was based on a phosphorous polyol (supplied by Virginia-Carolina Chemical Corp.) that provided a high degree of fire proofing; and another manufacturer (Polytron Corp.) recently made available a polyether foam which on burning forms a protective intumescent char layer over the surface of the foam that inhibits any further burning. And others—Dow, Mol-Rez, Wyandotte, and Pittsburgh Plate Glass included—report similar products on the way. The trick now seems to be to bring costs in line with non-treated materials.

A question of costs

With the base price of TDI at around 70¢/lb. and polyglycols at around 29¢/lb., rigid urethane foams still have somewhat of a cost problem as regards some of the materials with which they compete. Fibrous glass insulation, which is a direct competitor, costs about 2.5¢/bd. ft.; rigid urethanes average anywhere from 3.7 to 5¢/bd. ft., depending on the techniques used.

But producers feel that base costs are not the whole story. These producers have tried to hammer home the idea that rigid urethane is a unique material, that it can be put to best use by redesigning a product around its properties, and that many of the **(To page 181)**





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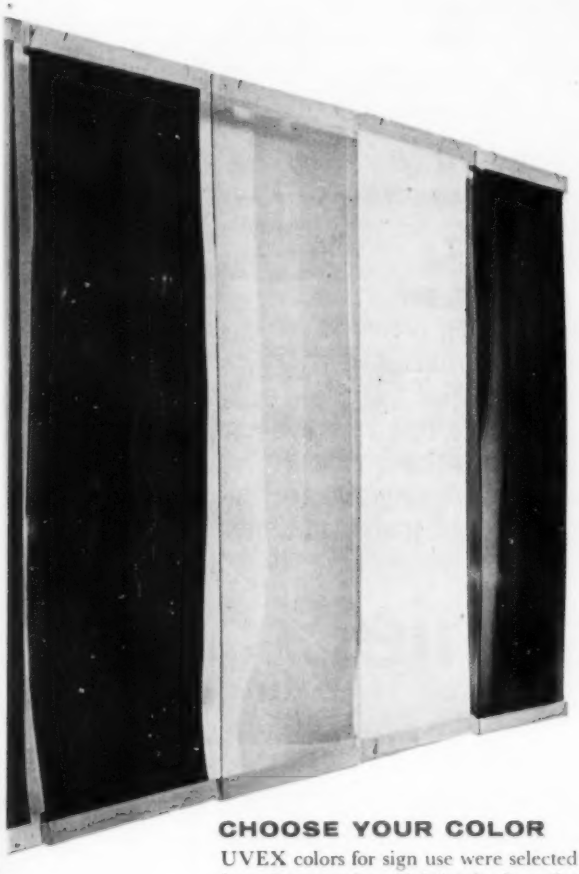

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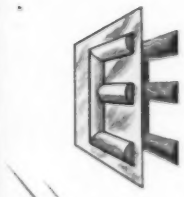

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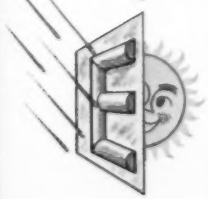

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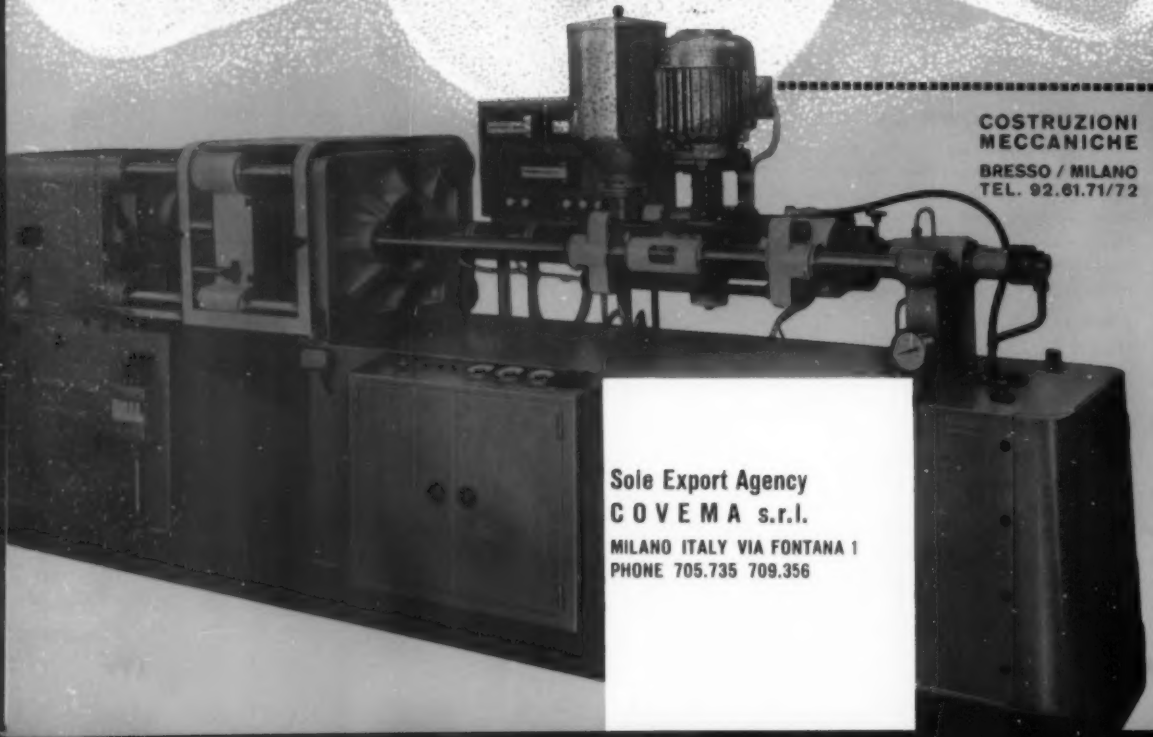

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cost savings are not too obvious to prospective end-users. One such savings, of course, is in the reduction in labor costs and in the reduction of on-site installation time. Here are some others:

1) Because of its outstanding insulating characteristics, about one-third to one-half as much foam need be used to attain the same insulating effectiveness. In refrigerators, this can be translated into more interior storage space in a given floor area; in trailers, more usable hauling space; in curtain-wall panels, a lighter weight unit with resultant savings on frames, mullions, and other superstructure; and in refrigerated storage vessels, greater cargo volume.

2) Rigid urethane's structural rigidity and its adhesion to the walls of the cavity in which it is foamed, means thinner-gage skins can be used with consequent reductions in structural parts costs. Although ordinary wall panels are fabricated of 16- to 18-gage metal skins, urethane foam-filled panels require only 22- to 24-gage skins. This applies, of course, not only to curtain-wall panels but to refrigerators, trucks, appliances, and automobiles. On the same basis, the use of rigid-urethane-foam filling for masonry cavity walls (see photo, p. 82) has resulted in important savings in construction by increasing load resistance and making it possible to raise the height of a 10-in. brick wall (with a 2½-in. void) from 12 to 18 ft. without additional support.

Another example: hollow rocket fins filled with foam-in-place urethane instead of cast aluminum structures cost only one-quarter as much, are lighter, and are stronger than conventional rocket fins, according to Atomic Energy Commission research. Elimination of core machining and external rivets and fasteners greatly reduce the cost of the fin while increasing its shear strength. The compressive load the fin sheet will carry is claimed to be equal to the material's yield strength (about 60,000 p.s.i.).

3) Moisture resistance is another one of those properties that can be translated into cost savings. One manufacturer of refrigerator trailer trucks reports, for example, that with conventional insulation materials from 1000 to 1500 lb. of moisture might be absorbed in the first

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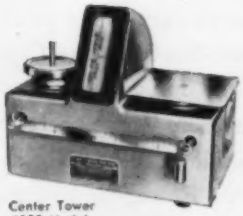
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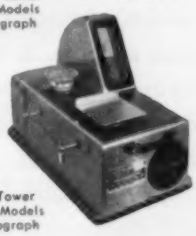
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year—at an annual cost to truckers of $1 per pound in reduced earning capacity. With rigid urethanes, the problem is eliminated.

4) New concepts in repair techniques can also be translated into cost savings. A hole punched into the rigid foam core of a reefer truck wall can be repaired simply by trimming out the damaged area, cutting a block of foam to fit the space, and then bonding it with a urethane foaming mixture.

5) The void-filling properties of liquid urethanes coupled with excellent adhesion to the walls of cavities represents economies when the foam is used as a potting material that can hold sensitive electronic components in a fixed position. The number of mounting brackets, clips, and attachments formerly used to brace the components can be drastically reduced. It is this same property that has reduced the need for internal supports in insulation panels—and the same property that gave the packaging industry its first insight into possible uses for the rigids.

Volume markets

Given these properties and characteristics, rigid urethane's market potential comes up clear.

Insulation for household refrigerators is one of the major markets to be cracked. A moderate amount of rigid foam has already been used in some models of refrigerators but foam producers feel that 1962 will be the jumping-off point to real volume usage that may eventually lead to a total market of 40 to 60 million lb. of foam a year by 1965. Price seems to be the big deterrent right now. Refrigerator manufacturers claim the cost of foam has to come down to eat up the 1.2¢/board ft. differential that fibrous glass insulation now enjoys before any real inroads can be made. Foam producers, while admitting there are possible price reductions in store if all these volume markets break loose, counter the need for price drops by pointing to the larger storage capacity possible with foam, the thinner wall sections that mean cost reductions, the adaptability of foam-in-place to production line automation, and the improved urethane technology that may make it possible to reduce the necessary foam density from 2.2 to 1.8 lb./cu. ft. while retaining the same effectiveness. Important market possibilities also exist for similar applications in household freezers, supermarket display cases, ice cream cabinets, small beverage coolers, and reach-in freezers.

In the transportation field, truck trailer vans and truck bodies, under the impetus of a recent ruling by the Association of Food and Drug Officials of the United States that requires all shipments of frozen foods not to exceed 0° F. during transit, may turn out to be the biggest immediate market for rigid foam insulation. A typical 40-ft. trailer requires some 1000 lb. of foam (at a density of 2.25 to 2.5 lb./cu. ft.) for proper insulation. Refrigerated railroad cars fall into the same category. And note that manufacturers are talking not only about using foam insulation in newly-built units but about the feasibility of spraying it on existing units (see photo, p. 86).

Rigid foam in the production of mobile homes and travel trailers—where again lighter weight and greater storage capacity is a factor—is another good possibility.

Together, these three applications—trailer trucks, railroad cars, and mobile homes—could account for 26 million lb. a year by 1965 and may go as high as 55 million lb. a year by 1970.

However, building construction is the bright star on the rigid urethane foam horizon. In the form of cores for residential sandwich panels of all types (exterior, interior, roof, and floor), as well as for curtain walls, non-residential roofs, door cores, perimeter insulation, and aluminum siding, rigid foam has possibilities for a 44-million-lb./year market by 1965 and a 100-million-lb./year market by 1970. Two current users of rigid foam for curtain walls—Caloric Architectural Porcelain, Div., Caloric Appliance Corp., Topton, Pa., and Michael Flynn Mfg. Co., Philadelphia, Pa.—report good consumer acceptance of the application and the former has gone so far as to predict that within three years rigid urethane as a core material will be used on about 60 to 75% of all curtain-wall panels produced.

All construction estimates, of course, are based on current trends and usage. If there should be any

sudden change in building concepts —say to complete modular panel usage—or any changes in building codes which now limit rigid foam's use or any reduction in in-place foam cost . . . then watch the rigids really take off!

In the marine field, reinforced plastics boats, requiring structural strengthening and added buoyancy, represent a potential market for rigid foam of 10 to 12 million lb. per year. Merchant and military vessels may well account for an additional 8 to 9 million lb. by 1965 —plus 3 to 5 million lb. a year for insulation of shipboard refrigeration compartments.

The entire field of low-temperature insulation is difficult to pin down to any figures. It seems logical to assume that in the future virtually all cold storage warehouses will be constructed by rigid frame techniques using urethane-insulated panels for walls and roofs. Pipe insulation, using preformed or foam-in-place techniques, is a growing market. And yet to be really evaluated are some of the spray-up applications for home and industry that have just hit the market. Spray-on insulation for electrically-heated homes, for example, may take on added importance because of the critical nature of the insulation required for this type of construction.

Similarly, it would be hard to pinpoint the exact market for rigid foam in military use, packaging, automotive, potting, or any of the other areas that have just discovered the design flexibility inherent in rigid foams.

But the direction is clear. Rigid urethanes are just getting off the ground—but they're already shooting for the sky. And end-users would be well advised to keep close tabs on their ascent!

* * *

Since much of the technology of urethane foams (*e.g.*, polyester vs. polyether, one-shot vs. prepolymer, etc.) has bearing on both flexible as well as rigid foams, this phase will be covered at the conclusion of next month's article. End-users interested in either rigid or flexible foams will also find in next month's article a comprehensive listing of the major suppliers of raw materials, foaming systems, slab stock, and equipment.—**End**

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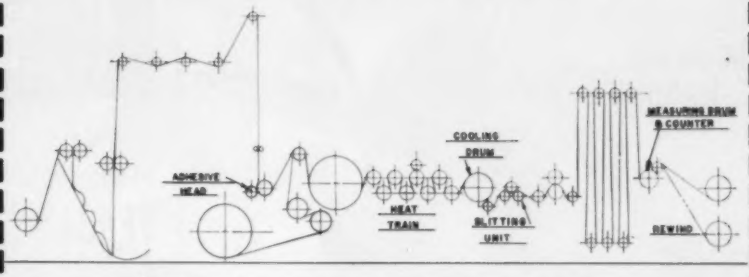

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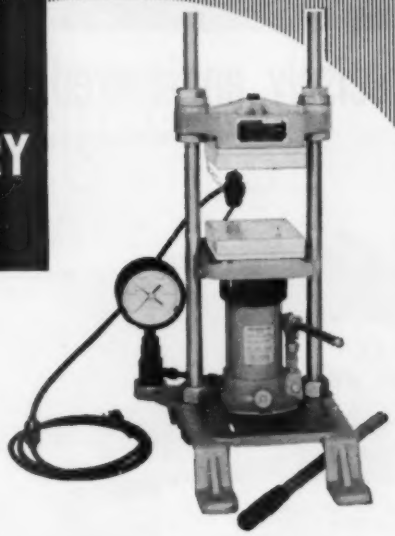

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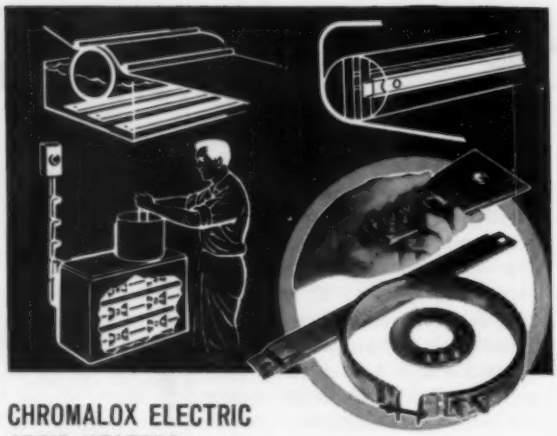

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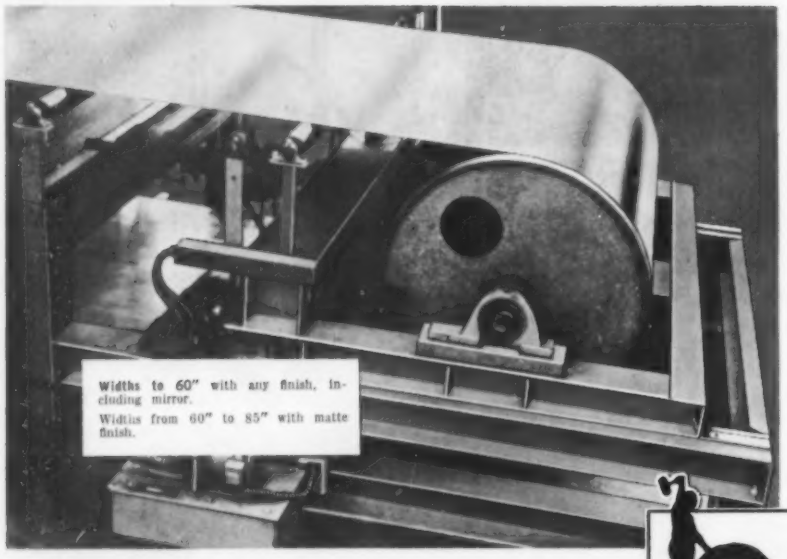

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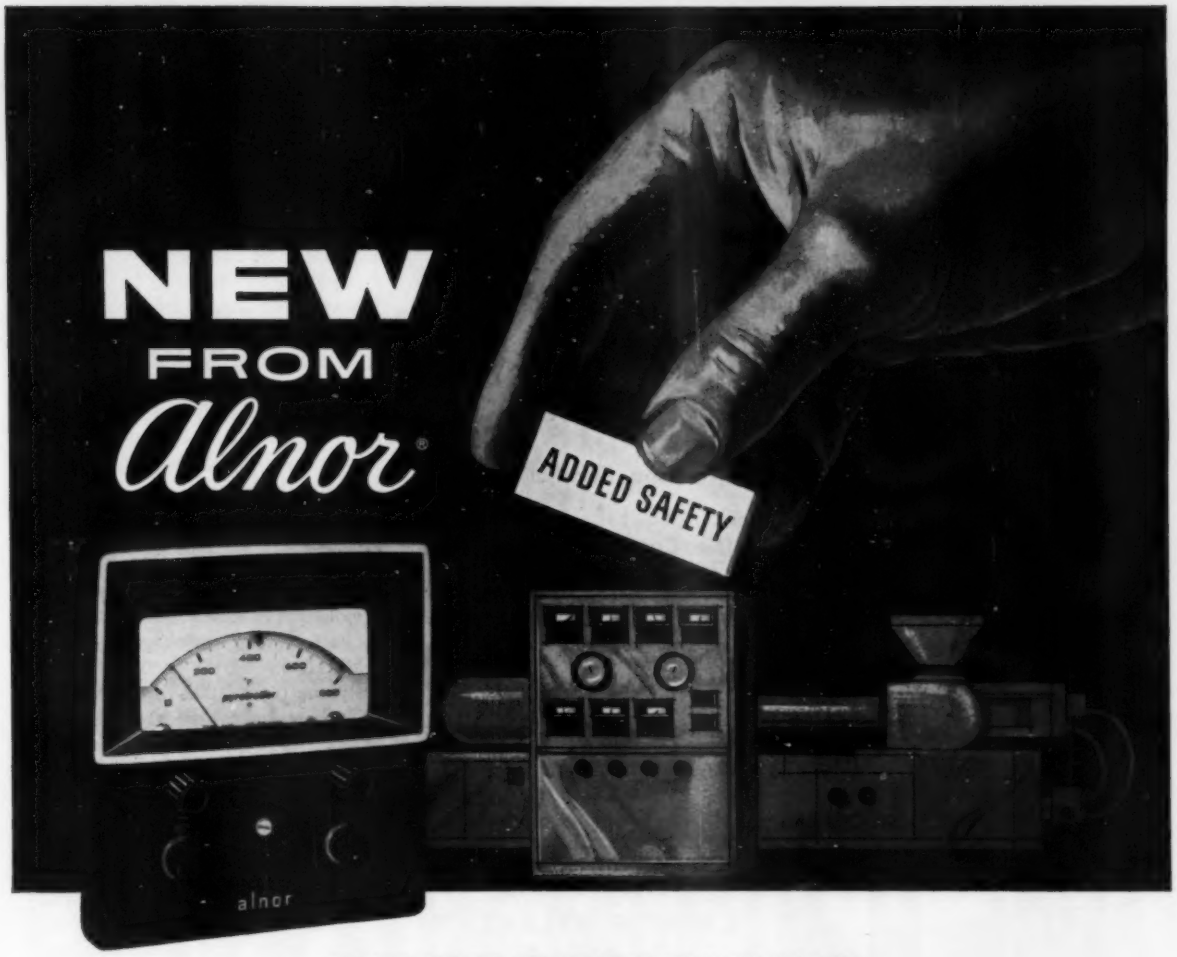

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PP molding

(From pp. 87-90)

but he will most likely have to make some adjustments when he processes the resin.

Shrinkage debated

Shrinkage is another important factor to be considered when molding PP. Polypropylene is claimed to have an advantage over other polyolefins in that it shrinks about the same in both directions; thus, it is often possible to mold flat pieces that are difficult to mold from other polyolefins. Post-molding shrinkage is said to be complete after 24-hr. period.

Mold shrinkage of PP is generally from 0.01 to 0.02 in./inch. This is about the same as nylon shrinkage, often making it possible to mold PP in molds built for nylon. (Polyethylene shrinkage is generally from 0.015 to 0.040, polystyrene from 0.003 to 0.005.)

According to several present and potential producers of PP who are also experienced and familiar with other plastics, this shrinkage factor will be an important element (along with price and stabilization, of course) in determining which items may be molded in PP in the future. One question, for example, is long-term shrink or long-time dimensional stability of PP. There is considerable debate over this subject.

There is also some question about PP's long-term load-bearing properties. It will easily carry its own weight, but there has not been enough time to thoroughly test its capability of carrying heavier weights over a long period. Perhaps the expected copolymer PP compounds will give a satisfactory answer to this question, but time is required to gain experience.

PP vs. styrenes

As noted in the table on p. 88, it is expected that a great portion of the molded PP items will become replacements for other materials. This implies that they will go into so-called engineered products. A further implication, then, is that many of these will be high-precision moldings. But not everyone is inclined to abandon the field before the claimed superiority of polypropylene. According to several technicians, most of whose lifetimes

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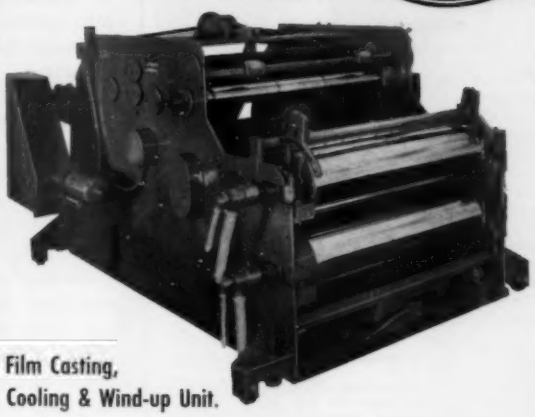

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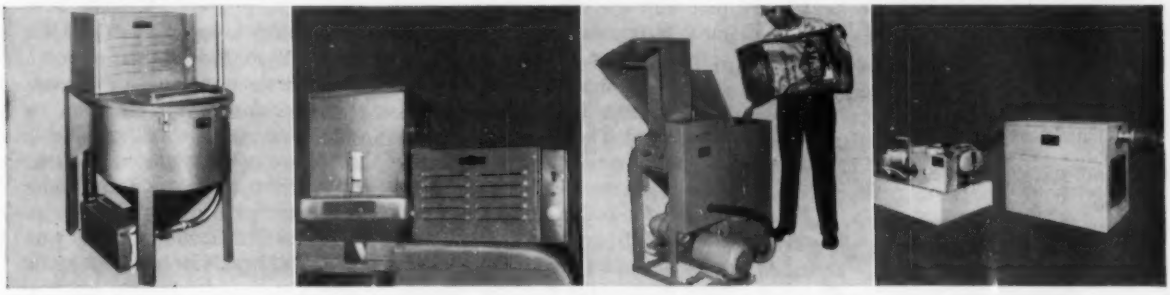

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have been spent in thermoplastic molding, precision molding is easier and less costly in styrenic materials even if the price of PP was equal to styrene. One of these technical men summed up his objections to PP with these examples: if a refrigerator breaker strip were molded in PP there would be trouble at the mitered corners because of shrinkage. He further opines that a PP wall tile wouldn't be square because it is not through crystallizing when it comes out of the mold and would shrink—despite the claims made for PP's equalized two-directional shrinkage. And if crystallizing is completed in the mold, our informant points out, the cycle would be too slow and costly.

Such, of course, are opinions of men who are more or less committed to styrenic compounds and who refuse to admit that PP will invade their domain to the point of devastation. But these same men also admit their comparatively limited experience with PP and acknowledge that PP formulations can be made in a variety of combinations that may overcome their criticisms. Each producer can vary his formulations by altering molecular weight and molecular-weight distribution and, again, PP can be altered or modified in many ways by copolymerization or even with filters to fit a given need. The molder's greatest puzzle may yet become that of choosing the right formulation for the right job.

When it comes to PP's ability to compete with styrenic materials, major producers of PP disagree in part with the views of the gentlemen mentioned above. They do agree that future consumption of PP molding material depends upon a lower price if big volume is to be attained. They point out that in the housewares field alone such items as vegetable bins, lids and handles for coffee makers, carafes, double-wall jugs, picnic ware, and vacuum bottles of PP are already being successfully marketed despite higher price. Built-in hinges and heat resistance are major factors in these moldings.

Some other properties in which polypropylene compares favorably with styrene are freedom from stress-crackings, good rigidity with resilience, flexural strength, and abrasion and vibration resistance. Molded containers are another possibility when price comes down. It is true that in large moldings, such as instrument and appliance housings, the molding has to be preheated in order to decorate it, but the end of this additional operation is in sight.

Impact resistance of PP is also being constantly improved, with numerous new formulations following one after another on the market. It is also probable that a new impact material without rubber will be introduced to help simplify the situation. PP has another advantage in injection molding: a sharp melting point, which means that it doesn't take long to cool in the mold. Thus it can compete with impact styrene at a higher price per pound because of savings accruing from more rapid cycles. In fact, the PP producers are happily looking forward to competition with styrene copolymers just as soon as they have sufficient material and experience. One major market they eventually hope to move in on is telephones.

PP vs. other plastics

Competition with other plastics is now and probably always will be an important part of the PP producers' business. In addition to competing with the styrenic materials, PP is expected to compete with the acetals, nylons and polycarbonates in many applications. The amount of competition with polyethylene in molding is still uncertain. In housewares, polyethylene and polystyrene are now dominant. The price of PP would have to be much lower for it to compete with polyethylene in this area on a larger scale than those items mentioned before and even then so many improvements are being made in polyethylene resins that PP would have a difficult time breaking in.

One area that has aroused particular interest is closures. PP is not only chemically inert but holds a given torque so that it remains tight and doesn't leak. It can also be designed to take normal variation in the thread of a glass bottle and its resilience permits molding of parts with deep undercuts that can still be removed from the mold with comparative ease. A good ex-

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ample is a fire-extinguisher-shaped cap for a popular burn ointment. A lipstick closure is another good example—the PP won't craze from chemical contact. One interesting closure uses a die-cut, reverse-printed PP film in the mold as an insert. Still another example is a closure with medicine dropper that gives better transparency, gloss, chemical resistance, and stiffness than could be obtained by using polyethylene.

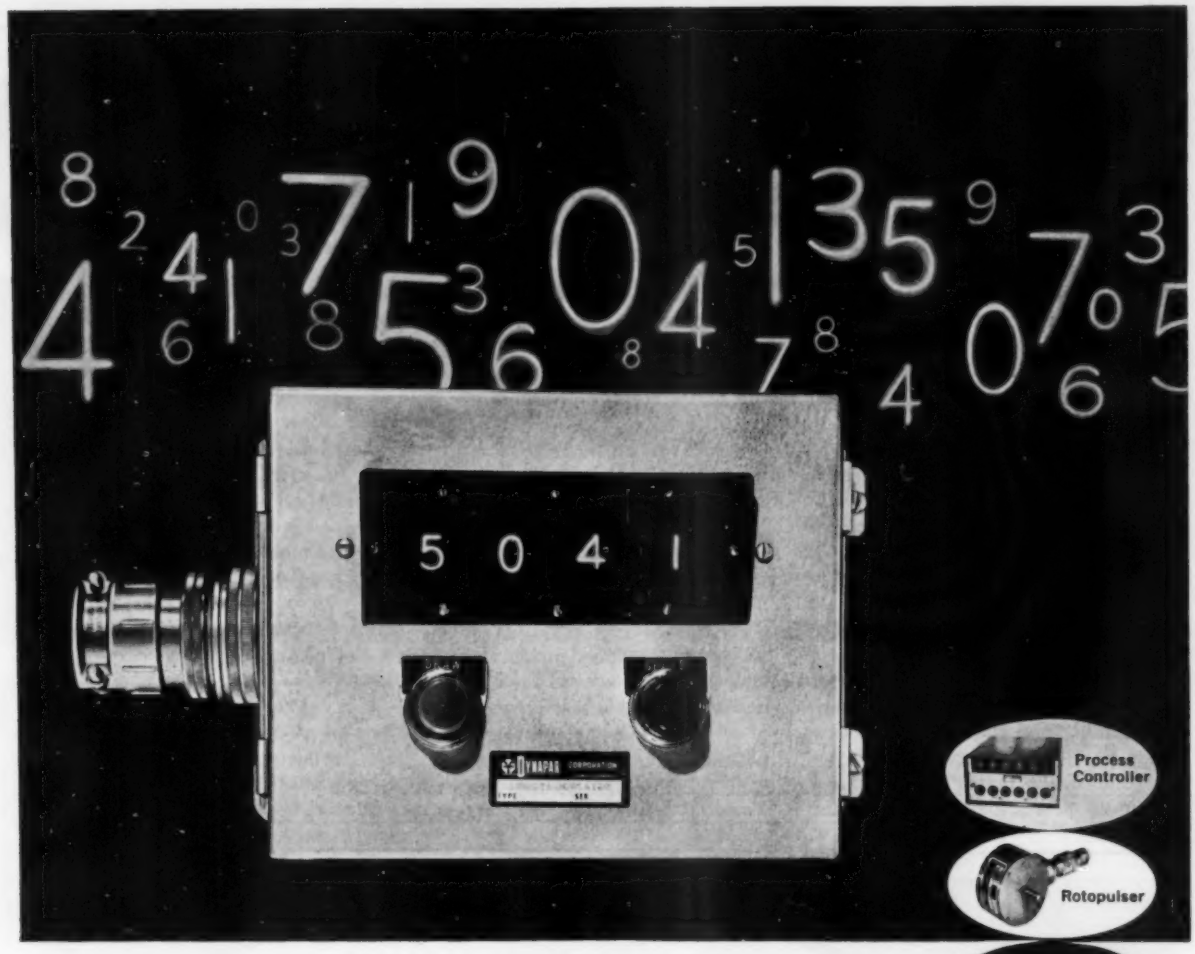
PP for blown bottles

Blow-molded bottles seem secure in high-density PE for a long time. There is some PP in bottles, but the industry is talking in terms of only 20 to 30 million lb. compared with an expected 300 to 400 million in polyethylene.

Blow-molded bottles of PP are not likely to be used where impact resistance at low temperature is important since a sharp shock on a cold, thin-walled bottle may break it. But a gallon drum, for example, could be thicker-walled and, where PP's high-temperature, impact, or corrosion resistance were necessary, would be practical. Small pharmaceutical bottles and big tanks may well be blow-molded of PP in the future. The petroleum industry is also counting on PP molded containers or PP-coated paper containers for 1- to 5-qt. sizes of motor oil.

However, there is no certainty over what will happen in the bottle business. In Europe there is now a returnable PP milk bottle that is said to make three times as many trips as glass. It has walls 15 or 20 mils thick, heavier than those used in detergent bottles in the U.S. It can, of course, be sterilized. Any such development in the U.S. would probably first be a non-returnable bottle with a thin wall, but PP's low-temperature flexibility has to be improved first. A coated paper stock may prove to be more practical for applications of this type in the long run.

Extruded PP squeeze tubes are also part of the container field and production figures are often listed in the bottle category. They are frequently made with injection-molded necks. For such tubes PP may not compete with polyethylene but it will compete with metal and vinyl chloride in product applications



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PP vs. non-plastics

Even though it is asserted that 60% of the PP sold today is for competition with other materials, applying polypropylene as a replacement for other materials in engineered parts is not easy. The prize-winning instrument cluster on the Valiant (MPI, July 1961, p. 186) is an example. Polypropylene was a candidate for the job but lost out to acetal. Industry men now say that PP was not yet ready to do the job but that this doesn't eliminate it from future consideration for this type of work. One engineer says that the way to use PP for an automobile dashboard is to redesign the complete job so that molding problems can be ameliorated. The old metal pattern, or a facsimile thereof, is no good for plastics. It takes time to learn engineering requirements that are new to plastics but it seems almost beyond doubt that PP has definite future possibilities as material for parts of homes, of machines, and other heavy-duty work. Improved resins and techniques will be developed to accomplish the job. Incidentally, the heaviest industrial molding in PP today is thought to be a 7-lb. tote box.

Before closing it is important to point out that the subject of PP's brittleness at low temperatures—often discussed in this article and elsewhere—has been sadly distorted. It's always a point picked out by competitors. Brittleness at low temperatures is not an unusual criticism of other materials either. While PP has mediocre low-temperature properties, corrective measures are possible to the extent that it is already as good or better in this category than vinyl, saran, or polystyrene. Some processing methods help tremendously. In general, items molded from PP will not take very rapidly applied loads at low temperatures; however, these same items will take a substantial amount of twisting, bending, or slow application of load at the same temperature. Improvement in low-temperature properties will increase potential applications in molding by as much as 40 to 50 percent.

It is also noticeable that various modified impact grades have good lower-temperature properties; thick walls with proper design also help. The Army has a telephone case that will withstand normal use at —40° F. Luggage cases (see MPI, Nov. 1960, p. 98) are said to be serviceable at 20° F. Temperature control and post-molding quenching will help improve PP's resistance. The inner doors of refrigerators were tried in PP before proper formulations were developed and thus aroused criticism. As all other plastics, PP has a few inherent properties that aren't the best in the world but it is doubtful that a potentially low-cost molding material with the excellence of properties presented by polypropylene has ever before bid for recognition in the industry.

—End of Part II

* * *

Part III of this series, dealing with film production and other forms of PP processing, will appear in a forthcoming issue.

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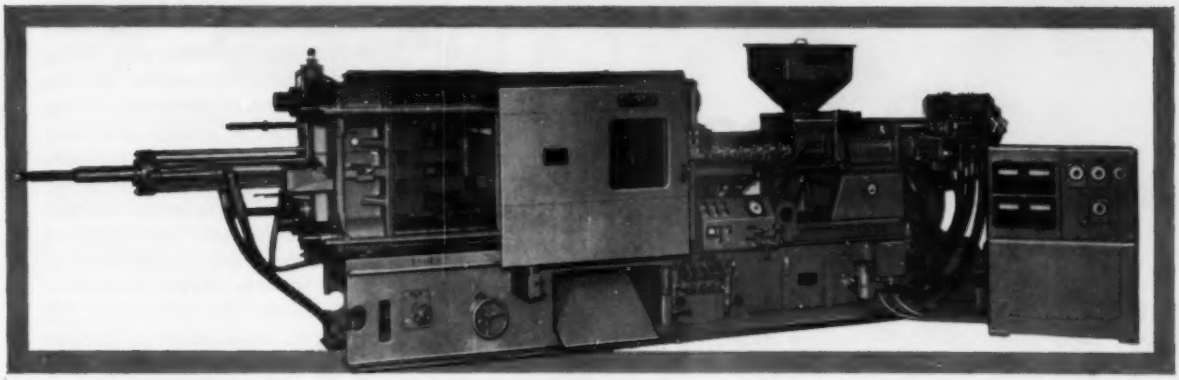

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	172.5 (40HP)	220 (50HP)	220 (50HP)	
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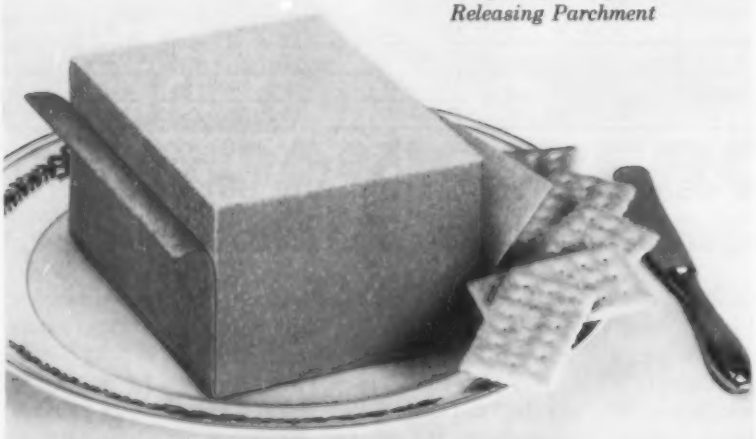

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Filament winding

(From pp. 94-96)

aircraft, textile, and chemical processing industries. Competition is with stainless steel tubing and with the more familiar plastics laminate tubing. In the latter area, one manufacturer reports that a filament-wound epoxy glass tubing proved out with burst strengths that exceeded those of conventional G-10 grades of plastics-glass tubing by about 3 to 1. In another instance, a filament-wound glass-epoxy tubing took a circuit breaker job away from a phenolic-paper laminate, despite its higher initial cost, because its greater structural strength permitted the part to be redesigned in a smaller, more compact version, which was also easier to install.

In smaller-volume markets, but along the same veins of product design, would be such applications as Winchester's filament-wound epoxy-glass shotgun barrel—a completely new concept in firearms described by the manufacturers as "lopping nearly a pound off the barrel by winding 500 miles of glass fiber around a thin steel tube."

Another application to be taken into account, particularly as an indication to manufacturers of electrical apparatus of a whole new approach to equipment design and function, is a filament-wound, epoxy-glass power boom (see photo, p. 94). Made for Asplundh Tree Expert Co., Jenkintown, Pa., by Young Development Div., Hercules Powder Co., the plastic's electrical properties protect the man aloft and the crew below from contact with high-tension wires. Previous booms were fabricated of metal tubes wrapped in an insulating material—an expensive production job. Heavier weight of metal also raised operational costs.

And here are some of the other commercial possibilities for filament winding already being tapped. Filament-wound ducting to replace aluminum units in building and aircraft applicatons has much potential. Filament-wound pipe, aside from its obvious possibilities in such industries as chemical, petroleum, paper, mining, food, and marine, is taking some unusual application directions. Most unusual reported to date is the use of piping made by Amercoat Corp., South Gate,

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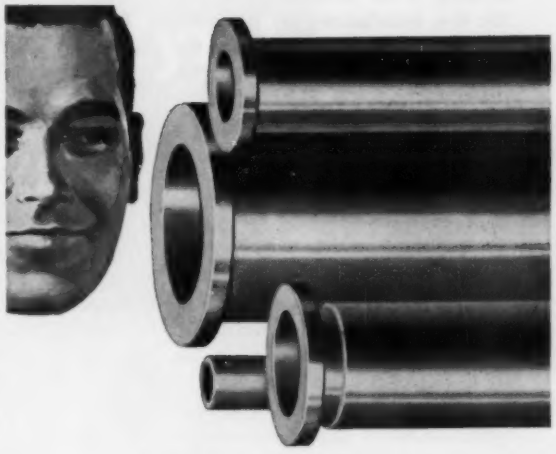

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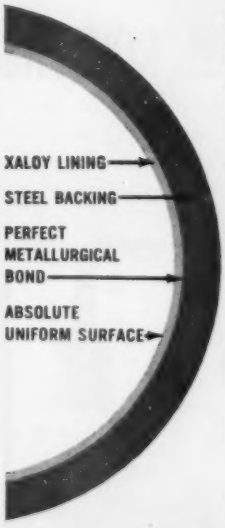

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Calif., as race track railing. According to the manufacturers, "on the first installation, the flexibility and resilience of the pipe saved the life of a horse during a mixup on the track."

Also in the west, one manufacturer has used the technique to make trash containers. Apex Reinforced Fibre-Glass Div., White Sewing Machine, Cleveland, Ohio, offers a line of filament-wound rings designed to provide internal support to reinforced plastics tubes subjected to external pressures of 500 p.s.i. The rings, ¾ by ¾ by 20 in. O.D., are wound and cured in tubular form and then cut as segments across the section of the tube. In Mexico, filament-wound lamp poles are reported to be in use. And in Sweden, the filament-wound under-carriage of an experimental light plane has aroused interest (see photo, p. 95). Landing tests have proved out the filament-wound unit with better shock-absorbing and damping properties than conventional under-carriages. It also provides a smoother ride on the ground, with less vibration and wear and tear on instruments and electronic equipment. Design specifications are now contained in Federal (U.S.) Aeronautics Administration equipment regulations.

Future possibilities

Reportedly under evaluation are a number of other filament-wound products—and their diversity might come as a surprise to those who feel the technique's potential is limited.

Industrial and packaging end-users, for example, should find much of interest in a new type of grommet currently being evaluated by Ordnance Corps, Picatinny Arsenal, Dover, N. J., as protection for the soft metal rotating band of artillery shells (see photo, p. 96). The conventional grommet now in use is fabricated of painted steel with a paperboard liner and is held in place with steel wires twisted together. Disadvantages are obvious: the metal is subject to denting or rusting, wire ties tend to loosen or break, and application to the shell cover is cumbersome. By going to a polyester-glass combination, the Ordnance Corps found they could eliminate corrosion problems and could design a unit that would simply slip over the shell and would hold itself in place with its integral resiliency. By going to filament winding as the production method, they found they could cut costs over comparable units made by matched-metal molding techniques, could design aluminum inserts as thumb holds into the part, and—simply by increasing or decreasing the number of glass filaments being wound—could fix the amount of force required to open the grommet.

At the other end of the scale in size are the filament-wound railroad tank cars of the type shown on the cover and on p. 96. These are being evaluated by at least two major manufacturers. Shape of the unit is ideal to take advantage of filament winding's economies and there are important costs savings involved in the material's outstanding strength-to-weight ratio (a 20,000-gal. tank car would represent a 5000-lb. savings in weight over comparable conventional units). Filament-wound tank cars

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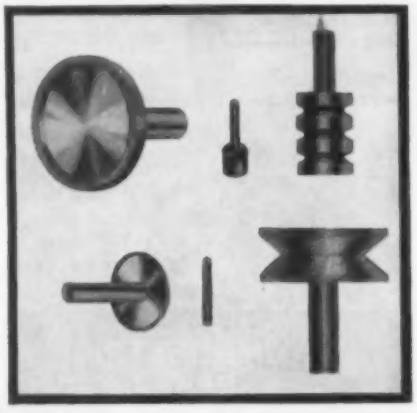

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Key to the selection of ZYTEL for this exacting application is the combination of properties offered by these resins: high mechanical strength and resistance to gasoline and petroleum products at high engine temperatures.

The Miser-Mite fuel-pressure regulator is molded by Artag Plastics Corp., Chicago, Ill., for Milemaster, Inc., Exeland, Wisconsin.

On the next page you will find more examples of how the properties of ZYTEL nylon resins are being used to improve the design and performance of products in a variety of fields.

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Electric motor brush holder used in an improved electric impact wrench is a one-piece molded part of ZYTEL, providing excellent electrical insulation properties, wear resistance and high strength. Cost, including parts and assembly time, is 65% less than the three-piece fabricated brush holder assembly previously used. Molded by Amos-Burke Plastics, Inc., Syracuse, N. Y., for Chicago Pneumatic Tool Company, Utica, N. Y.

Swivel chair hub liner molded of ZYTEL® eliminates necessity of lubricating center spindles, maintains a wobble-free, tight fit through long periods of use. ZYTEL nylon resin was selected for its low coefficient of friction, resistance to impact and abrasion, and close molding tolerances. Molded by Nylon Products Corp., affiliated with F. J. Kirk Molding Co., Clinton, Mass., for Collier-Keyworth Company, Gardner, Mass.

Removable cleanout plug allows cleaning of sewage drainpipes. Molded of ZYTEL, the plug can be removed easily time after time, does not stick—because ZYTEL nylon resin resists the accumulation of mineral deposits from water. Quick, accurate injection molding eliminates need for sand casting and thread machining required by brass plugs. Coast Craft Industries, Glendale, California, for A. H. Voss Co., Los Angeles, California.

Three useful properties of ZYTEL® NYLON RESINS: high insulation . . . low friction . . . good moldability

Depending on the particular application, different combinations of properties offered by ZYTEL nylon resins become crucial—as witness the applications discussed on this page and the preceding page. To evaluate the design opportunities offered by ZYTEL for your application, consider the entire range of properties offered by ZYTEL nylon resins, and the many different formulations of ZYTEL available. The coupon below will bring you pertinent further information.

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for trucks are the obvious corollary. One manufacturer has also been experimenting for some time with a 40-lb. filament-wound boat of the round-nose type that could accommodate four people and is light enough to be carried atop a car. Boats of this type could be made by winding a radome shape such as is shown on p. 96 and cutting it longitudinally in half. There are many bugs still to be ironed out, but there is much confidence in the adaptability of the technique to the under-12 ft. boat market now dominated by aluminum.

Here are the other possibilities that filament winders talk about today: ladders, highway stanchions, drive shafts, buoys, pontoons, and air brake cylinders and diesel tanks. Sandwich-type constructions can also be made by winding one skin of filament on a mandrel, laying a honeycomb or foam core over it while it is still on the mandrel, and then winding the second skin directly over the core.

And to put the icing on the cake, two of the processors interviewed in the course of this survey mentioned the feasibility of filament-wound leaf springs that could conceivably be made in volume quantities at one-half the cost of spring steel.

Materials developments

Recognition of filament winding's future is also being made by those materials suppliers who are starting to produce resins and reinforcements especially with the winding market in mind.

In the area of reinforcements, much better consistency has been achieved in E glass fibers and new finishing methods have contributed to raising their average strength. Glass fibers with higher modulus made possible through the addition of beryllia are also available for applications where deflection considerations may necessitate their use. Among other types of reinforcements, high-strength wires with tensiles of 480,000 to 500,000 p.s.i. are being researched.

In resins, the epoxies have turned out to be the general-purpose materials. Most in use today are conventional A-epichlorohydrin epoxies but formulations specifically tailored to fit the requirements for filament winding are beginning to make an

Portrait of a pigment

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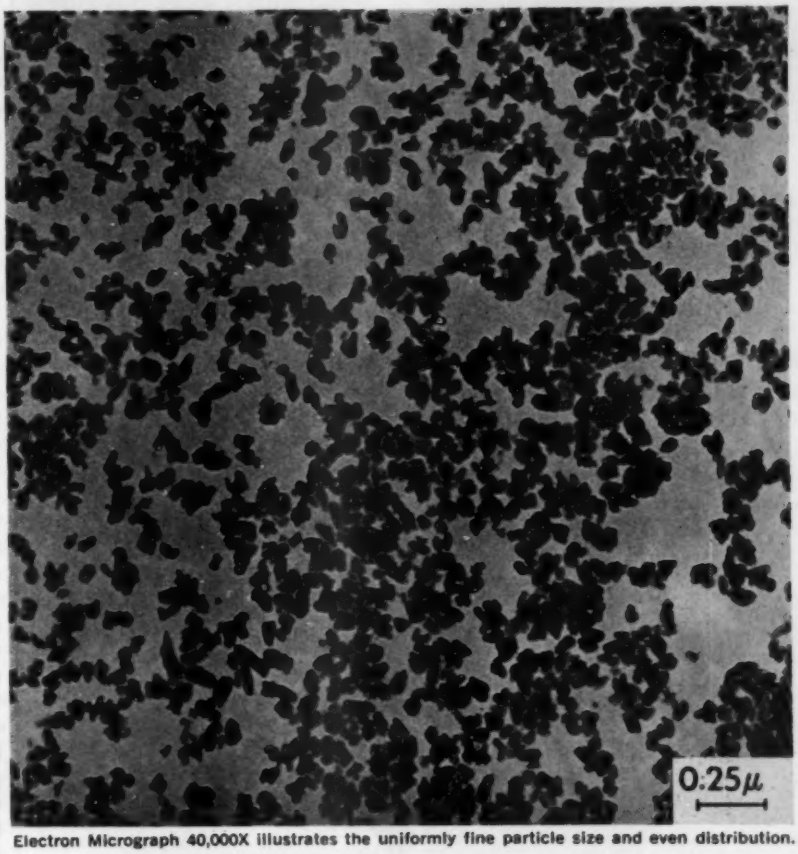
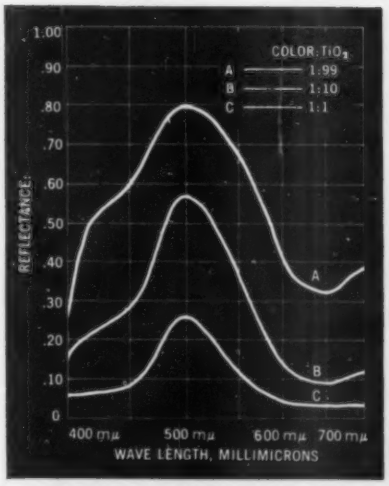


Electron Micrograph 40,000X illustrates the uniformly fine particle size and even distribution.

cyan green 15-3100



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appearance. Special low-viscosity resins, peracetic-modified resins, di-epoxies, novolacs, epoxidized poly-olefins, etc., are all currently being evaluated.

Polyester resins are being used where certain electrical characteristics and heat resistance are called for. Phenolics, which have better ablation characteristics, and silicones, which also show certain improvements in electrical properties, have been used mainly for missile and other military applications. Polyurethane resins, which show promise because of good bond strength and toughness, are being evaluated for filament winding.

Keeping pace with materials development is the work being done on winding techniques. Epoxy prepreg rovings, for example, are now obtainable in a wide variety of resin systems; and techniques of packaging the rovings have been improved to the point where the prepregs can successfully replace wet winding (where the filament is drawn through a bath of resin before winding) in a number of applications. Though the prepregs are more costly, they make it possible for smaller manufacturers without plastics formulating facilities to consider the use of filament winding; in addition, the use of prepregs reopens the market to phenolics and silicone impregnating resins which are difficult to wet wind.

No matter what direction is taken in refining techniques, however, no one can deny any longer that filament winding does have commercial possibilities. It is now up to the end-user to make the most of them.

Credits: Special thanks for assistance in the preparation of this article to Union Carbide Chemicals Co. and to Shell Chemical Co., both suppliers of epoxy resins for filament winding; to the suppliers of fibrous glass filaments for winding; to Young Development Div., Hercules Powder Co., Rocky Hill, N. J. and Lamtex Industries, Farmingdale, N. Y., both of whom are in the business of filament winding. In addition to the filament winders mentioned in the article, thanks are also due to Lockheed Aircraft Corp., Burbank, Calif.; Swedlow Inc., Los Angeles, Calif.; and Walter Kidde Co., Belleville, N. J.

—End

PE tames neutrons

(From pp. 97-99)

allow for any expansion, and individual sheets are staggered as they are laid in place so that openings at their edges do not align.

Procedures for installing radiation shielding vary little for nuclear-powered ships of varying design. Such minor differences are usually in the thickness of the individual shielding layers. However, in some instances a special procedure for shield construction is used. Phenolic casting resin loaded with PE pellets is used to fill in corner spaces, areas around pipes, and other shielding sections where the installation of cut-to-shape sheets is difficult. The phenolic-PE pellet mixtures, which are compounded by the shipbuilders, are poured by hand into the hard-to-get-at areas requiring shielding.

Nuclear-powered aircraft

The most important application of PE's neutron-shielding properties—high effectiveness combined with light weight—may be in nuclear-powered aircraft. As this article is written, projects leading toward actual production of such an airplane have been curtailed by the unavailability of funds. However, there have been appropriations for the continuance of research and development programs.

In one of these programs, much attention has been devoted to working on the development of effective radiation protection for airborne personnel. Neutron shielding of rubber, evaluated in early development phases, has now given way to high-density PE shielding, which is said to be the best material for meeting future physical requirements and design variables in nuclear planes. High-density PE meets these three major requirements: it has the structural integrity needed to withstand aerial maneuvering, loads, and vibrations encountered in flight; it is compatible with other structural materials and with the range of physical environments in which nuclear-powered aircraft must operate; and it presents no personnel hazard during the production, use, or maintenance of a shielding system.

One aircraft company has adopted a method of heat welding PE sheets into a neutron barrier. The edges of the two sheets to be joined are melted by a strip heater element, butted together, and allowed to cool.

Applications in stationary reactors

A considerable amount of PE neutron shielding is also used at land-based reactor plants and at nuclear research laboratories. While weight and bulk are not as critical factors here as in ships and planes, the fact that many reactor shields are designed for frequent dismantling and re-erection has favored PE over, for example, concrete.

Representative of research centers where polyethylene plays a big role is Industrial Reactor Laboratories, Plainsboro, N.J. This facility is a joint undertaking by 10 noncompetitive companies which conduct radiation research related to their particular products. Among the companies is U. S. Industrial Chemicals Co., which orients research to its PE resins.

In addition to neutron shielding for the research reactor, several other applications of PE are to be found at this laboratory. Containers made of the material are used to house materials which are to be subjected to atomic radiation. These containers, known as "rabbits," are filled with samples to be irradiated, then transported through pneumatic tubes into and out of specific reactor zones.

Radiation will eventually destroy the PE containers, just as they would destroy containers fabricated from any organic compound, but PE has the longest service life of all these compounds. The life of a polystyrene container in a reactor, for example, is only 5 to 10 min., while a low-density PE "rabbit" lasts for about 2 hours. High-pressure-processed (low-density) material is more desirable in this use, since catalyst traces in the low-pressure (high-density) resins often become dangerously radioactive.

Credits: For assistance in the preparation of this article, the editors thank the following companies: Industrial Reactor Labs.; Phillips Chemical Co.; St. Regis Paper Co., Panelyte Div.; U. S. Industrial Chemicals Co., Div. of National Distillers & Chemical Corp.; Union Carbide Plastics Co.; and Westinghouse Electric Corp., Micarta Div.—**End**

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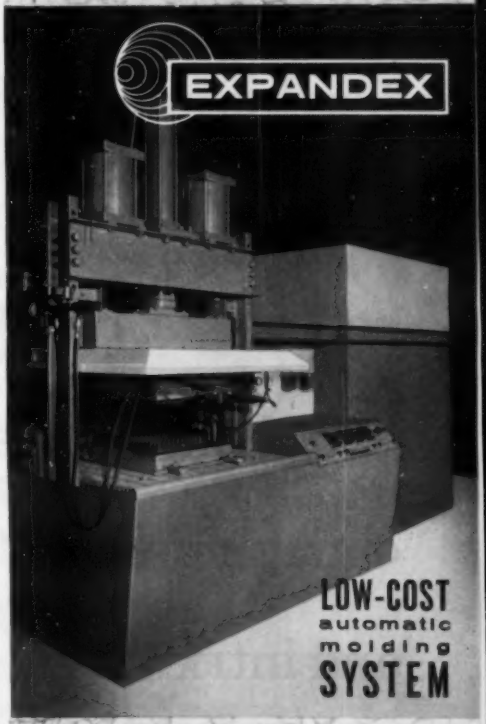

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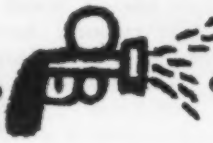
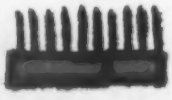
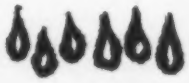
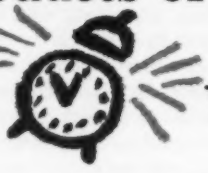
Using a binder especially formulated for this application,  Johns-Manville Gun Roving has chemically-controlled chopping characteristics. It is static-free, chops cleanly, and lays down evenly without clumping. It conforms readily to sharp radii and intricate shapes because it is soft, not stiff  and wiry like other products of this type. It wets out  quickly  with

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Outer space

(From pp. 100-101)

epoxy resin made possible a completely homogeneous bond of metal-to-glass cloth-to-honeycomb in a critical area of the satellite. The interior skin of the honeycomb consisted of a third layer of pre-impregnated glass cloth draped over the honeycomb and likewise oven-cured. Resin for this layer was pigmented with carbon black.

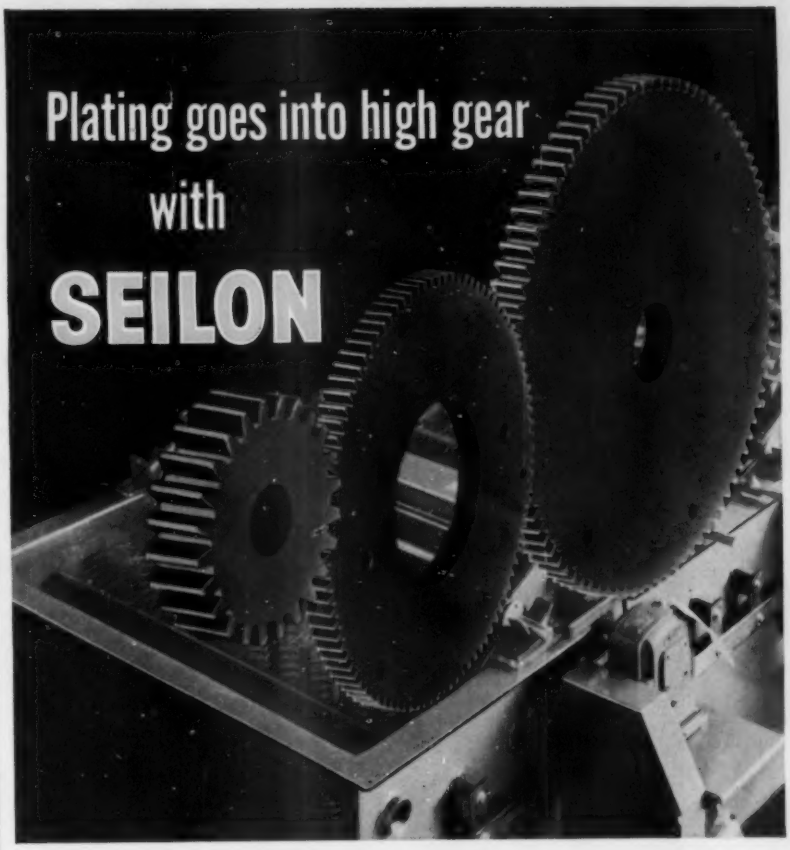
The other hemisphere of the Courier shell was constructed in a similar manner. Total weight of both reinforced epoxy hemispheres was only 38 pounds.

An additional step in shell construction was to set dish-shaped metal plates at the poles of both hemispheres. The plates were vibration-dampened by molded polyurethane foam sections, and were integral with the satellite's space frame. The plate positioned at the southern pole was attached to the interface flange.

Construction

Most of the electronic equipment was mounted on both sides of three platforms made of honeycomb sandwich panels. The center platform, approximately 51 in. in diameter and 1¼ in. thick, was located on the equatorial band of the shell. The two smaller platforms, 22½ in. square and 1 in. thick, were positioned 11 in. "north" and "south" of the sphere's equator. All three were attached to the octahedron space frame at four edge points and to a center aluminum tube. This tube was designed to distribute loads from the space frame to the platforms.

The 0.030-in.-thick skins for the platforms were made up of three resin-prewet plies of glass cloth molded on a flat platen. The phenolic-nylon honeycomb core was cut to shape and placed on the wet cloth. This assembly was vacuum-bagged and oven-cured. After cure, the honeycomb core was hobbed out to receive the rectangular aluminum insert which provided the means of attaching the platform to the space frame. The insert was coated with an epoxy adhesive and set inside the honeycomb, which was then covered with its top skin of three plies of prewet glass cloth. The complete sandwich



METAL GEAR DRIVES for plating barrels had never been wholly successful. In certain solutions the metal would deteriorate and cause contamination. Maintenance and replacement costs were high. Plastics had been tried, but no plastic was found that wouldn't swell, distort, crack, coat-up, or simply dissolve in some plating solution, acid or alkali, at temperatures up to 220°F. None, that is, until The Singleton Company of Cleveland discovered . . .

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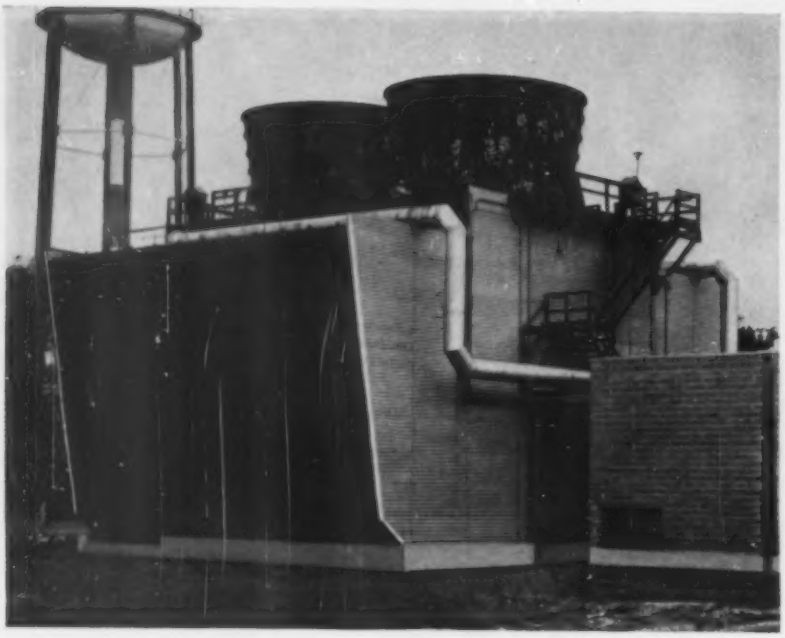

structure was vacuum-bagged once again and the adhesive and laminating resin were oven-cured at the same time.

Carbon black was added to the laminating resin for thermal control reasons. In addition to their role as supporting structures, it was important that the platforms be heat-absorptive to control the environmental temperatures to which the electronic components would be subjected.

The various instruments were mounted on both sides of the three platforms by means of internally-threaded aluminum inserts which were run through the honeycomb.

Making the molded flange

The interface flange plate which attached the satellite to the launch vehicle and took the entire launch load, was approximately 9 in. in diameter. It was secured to the satellite by 12 bolts. V-shaped clamps fastened around this plate and a mating plate on the rocket. These clamps were held in place by two explosive bolts which were detonated on signal to release the satellite into orbit.

The flange plate was pressure-molded from fibrous glass-reinforced epoxy resin. It was made up of multiple layers of impregnated glass cloth resulting in a thickness of about ¾ inch. The layup was made in rough plate form, then vacuum-bagged, and oven-cured.

Conditions in outer space, and enroute thereto, are undoubtedly among the most severe a material can be called upon to withstand. The fact that the Courier satellite has survived them unscathed suggests applications of the same materials of construction and related designs to industrial problems. As the article on p. 94 of this issue makes amply clear, plastics processes and material utilization born of the space and military programs, have a way of finding their place in the civilian economy as well. And it can thus be expected that the Courier launching will generate some interesting ideas in the communications, transportation, and other fields.

Credits: Shells, platforms, and flange produced by Summit Industries Inc., Gardena, Calif.; Epon 828 resin by Shell Chemical Co.; fibrous glass by Thalco, Los Angeles.—**End**

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POLYCOR COOK'S RESINS

Vacuum system

(From pp. 105-109)

of blow pressure used in preblow forming, p.s.i.a.;

P_a = dead-end pressure of the vacuum system (usually about 1 p.s.i.a.);

P_w = desired working pressure for the forming operation, p.s.i.a.

Note that V_s includes all piping as well as the reservoir between the control valve and the vacuum pump. Pipe volume must be subtracted from V_s to find the volume of the reservoir tank or vessel. Also, note that P_a is the dead-end pressure, or pressure of the vacuum system with the control valve shut-off. This system dead-end pressure will usually be somewhat higher than the dead-end pressure of the vacuum pump itself, depending on leakage and other factors; usually about 1 p.s.i.a. (vacuum of 27.9 in. of mercury) for the system as compared with 0.5 p.s.i.a. (vacuum of 28.9 in. of mercury) for the pump. A sample problem follows to illustrate the use of Eq. 1.

The problem is to determine what size reservoir would be necessary to produce a working or forming pressure of 2.5 p.s.i.a. (vacuum of 24.8 in. of mercury) in a system such as shown in Fig. 2, p. 106, with a mold volume of 3 cu. ft. (including piping from the mold to the control valve). Assume that a pump with a dead-end pressure of 0.5 p.s.i.a (vacuum of 28.9 in. of mercury) is used and is capable of producing a dead-end system pressure of 1 p.s.i.a. (vacuum of 27.9 in. of mercury). Assume the operation is a straight thermoforming job and no preblow air is used, so that initial mold pressure is atmospheric, or 14.7 p.s.i.a.

Substituting in Eq. 1 given above, we get

$$(3)\ (14.7) + (1)\ (V)_s = (2.5)\ (V_s + 3) \qquad \text{Eq. 1a}$$

Solving for V_s

$$V_s = 24.4 \text{ cu. ft.} \qquad \text{Eq. 1b}$$

To determine the volume of the actual reservoir vessel alone, the volume of whatever amount of piping is to be used between the vacuum pump and reservoir and between the reservoir and vacuum control valve should be subtracted from the volume calculated in the above data.

Determining minimum cycle time

As mentioned previously, the factor limiting production rate is the maintenance of the required ratio of vacuum-system recovery time to the cycle time. The forming cycle time, T_c, should be at least double the recovery time, T_r, required for the system. Recovery time is here defined as the difference between the time, T_s, which is required for the pump to evacuate the entire vacuum system including reservoir, mold volume, and piping, to dead-end pressure (about 1 p.s.i.a. or a vacuum of 27.96 in. of mercury); and the time, T_m, is required to evacuate the entire system to the forming or working pressure required in the mold during operation on cycle. Or, stated symbolically

$$T_r = T_s - T_m = T_c/2 \qquad \text{Eq. 2}$$

The time in minutes, T_p, required for any particular pump with a piston displacement of PD cu.ft./min. to evacuate a system with a total volume of Q cu. ft. to a specified pressure of P_x p.s.i.a. can be determined from the formula

$$T_p = \frac{Q}{PD} \log_e \frac{P_d - P_p}{P_x - P_p} \qquad \text{Eq. 3}$$

where P_d is the discharge pressure of the pump in p.s.i.a. (usually atmospheric pressure, or 14.7 p.s.i.a.) and P_p is maximum pump vacuum with pump's intake closed (dead-end pressure of pump).

For convenience in calculations when using vacuums, expressed in inches of mercury, of the quantities in Eq. 3

$$\log_e \frac{P_d - P_p}{P_x - P_p}$$

has been graphed in Fig. 3, p. 107, for various values of P_x and P_p expressed in terms of inches of mercury. Using Fig. 3, the value of the quantity above can be read directly from the graph by locating P_x on the vertical scale; reading horizontally to find this value on the curve corresponding to the dead-end vacuum P_p being used in the calculation, and then reading the value of the $\log_e$ of the quan-

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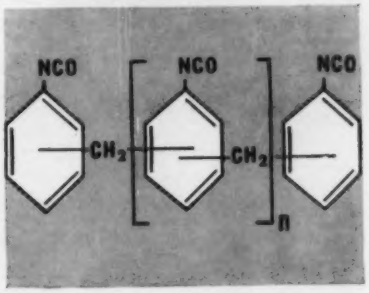

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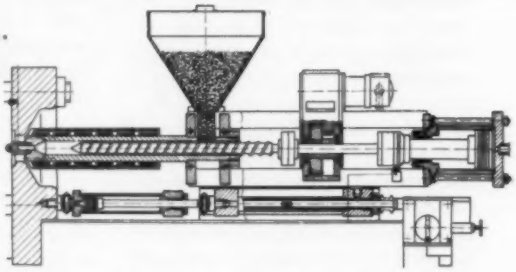

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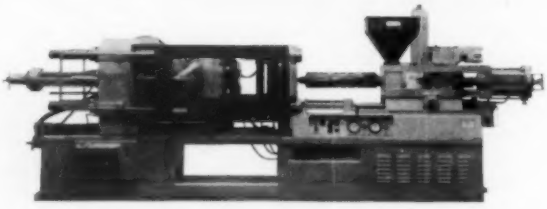

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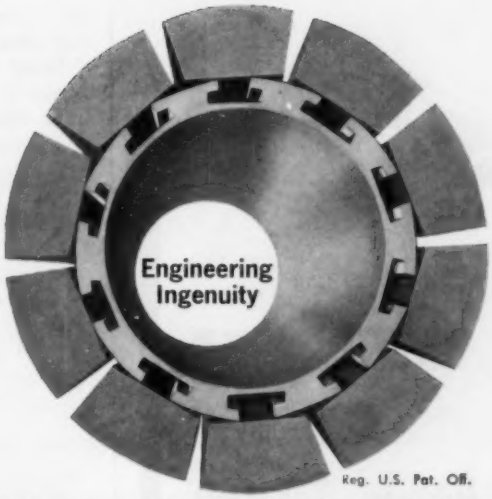

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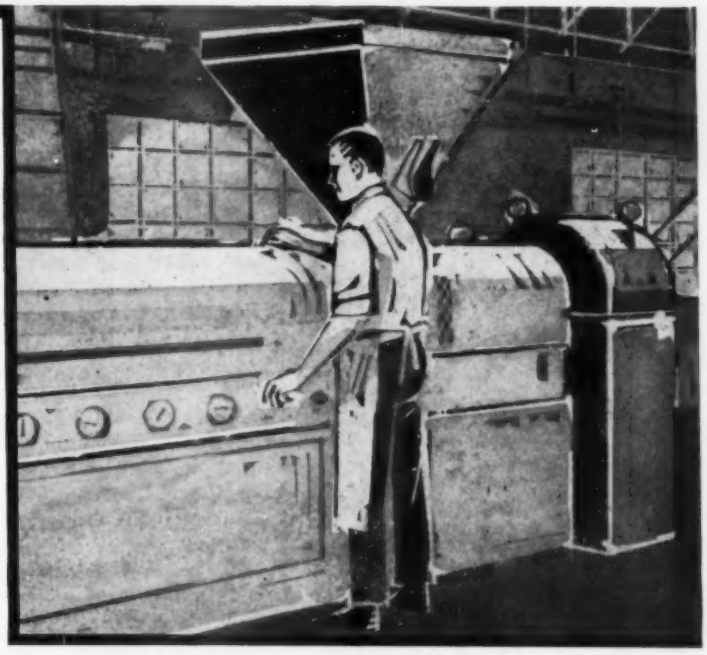

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tity on the abscissa directly below this point.

Using Eq. 3, T_s and T_m in Eq. 2 may be determined separately by using either the dead-end pressure of the system (usually 1 p.s.i.a. or 27.9 in. of mercury) or the desired molding or working pressure, P_w, as values of P_x. Having T_s and T_m, recovery time, T_r, may be determined from Eq. 2 and subsequently minimum permissible cycle time, T_c, which must be at least twice as large as T_r. Use of Eq. 3 will be demonstrated in the next section of this article.

Sizing the vacuum pump

Determining the piston displacement, PD, of the pump required will fix the size of the pump required for a given application. Knowing the cycle required, T_c, the volume of the system to be evacuated, Q, and the working pressure, Eq. 3 may be used along with Eq. 2 to solve for PD, or piston displacement.

Note that, Q, as used in the equation is the total volume of air to be evacuated and should include the volume of air which enters the system per cycle due to leakage of the equipment. This may be considerable in some set-ups; however, in the illustrative problem showing how a pump is selected for a specific application, leakage will be disregarded.

In this case, assume a forming machine is to be used for straight vacuum forming and the volume of the mold is 3 cu. ft., including its associated piping back to the vacuum control valve. Production rate is to be 30 formed parts/hr.; cycle time, T_c, is 2 minutes. The vacuum system between the pump and the vacuum control valve contains an 80-gal. (10.7-cu.-ft.) reservoir. One hundred ft. of 3-in. pipe will connect the pump and reservoir system to the vacuum control valve on the forming machine. The volume of 100 ft. of 3-in. pipe is 4.5 cubic feet. A single-stage vacuum pump will be used and the pump's dead-end pressure P_p will be 0.5 p.s.i.a., or a vacuum of about 28.9 in. of mercury; the dead-end pressure of the over-all system will be assumed to be 1 p.s.i.a., or a vacuum of about 27.9 in. of mercury.

From this given information the cycle, T_c, required is 2 min. per part. Then the recovery time, T_r, must be 1 min. ($T_c/2$) and, using Eq. 2, we get

$$T_s - T_m = 1 \text{ min.} \qquad \text{Eq. 2a}$$

To determine T_s and T_m, use is made of Eq. 3 as follows. First, T_s, the time to pump down the entire system to the system's dead-end pressure, (assumed to be 1 p.s.i.a. in this example) may be found by substituting in Eq. 3 as follows:

$$T_s = \frac{Q}{PD} \log_e \frac{14.7 - 0.5}{1.0 - 0.5} \qquad \text{Eq. 3a}$$

The value of the $\log_e$ may also be found in Fig. 3 by using a P_x equal to the dead-end vacuum of the system of 27.9 in. of mercury with the 29 in. of mercury dead-end pump vacuum curve; using this graph the value of the $\log_e$ is found to be about 3.35. Therefore,

$$T_s = 3.35 \frac{Q}{PD} \qquad \text{Eq. 3b}$$

Next, determine the time, T_m, to pump down the over-all system to working pressure, P_w. The working pressure for the system described is found by substituting in Eq. 1 as shown below

$$(3)\ (14.7) + (10.7 + 4.5)\ (1) = (3 + [10.7 + 4.5])\ P_w \qquad \text{Eq. 1c}$$

or $P_w = 3.26$ p.s.i.a., or a vacuum of 23.3 in. of mercury.

As can be seen, this pressure is well below 5 p.s.i.a. and is an adequate working pressure for vacuum forming. Using this working pressure and Eq. 3 with Fig. 3

$$T_m = 1.64 \frac{Q}{PD} \qquad \text{Eq. 3c}$$

Dividing Eq. 3b by 3c we may solve for T_s in terms of T_m or

$$T_s = 2.04\ T_m \qquad \text{Eq. 3d}$$

Substituting the value of T_S from Eq. 3d in Eq. 2a

$$2.04\ T_m - T_m = 1 \text{ min.} \qquad \text{Eq. 2b}$$

$$T_m = 0.957 \text{ min.} \qquad \text{Eq. 2c}$$

$$T_s = 1.955 \text{ min.} \qquad \text{Eq. 2d}$$

Using Eq. 3b, we may finally solve for piston displacement, or

$$PD = 3.35 \frac{Q}{T_s}$$

$$PD = \frac{(3.35)\ (18.2)}{1.955}$$

$$PD = 31.2 \text{ cu. ft./min.}$$

Having the piston displacement

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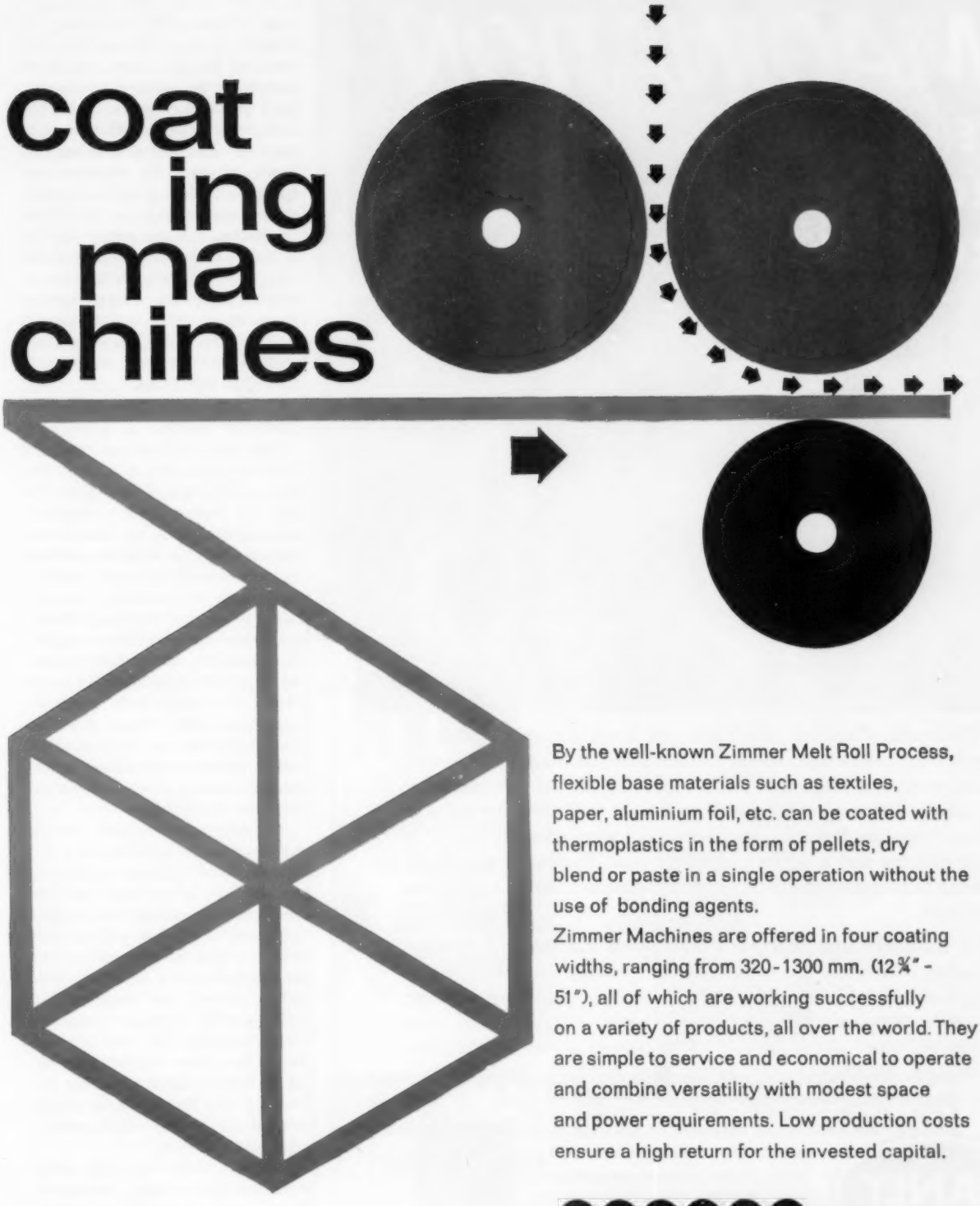

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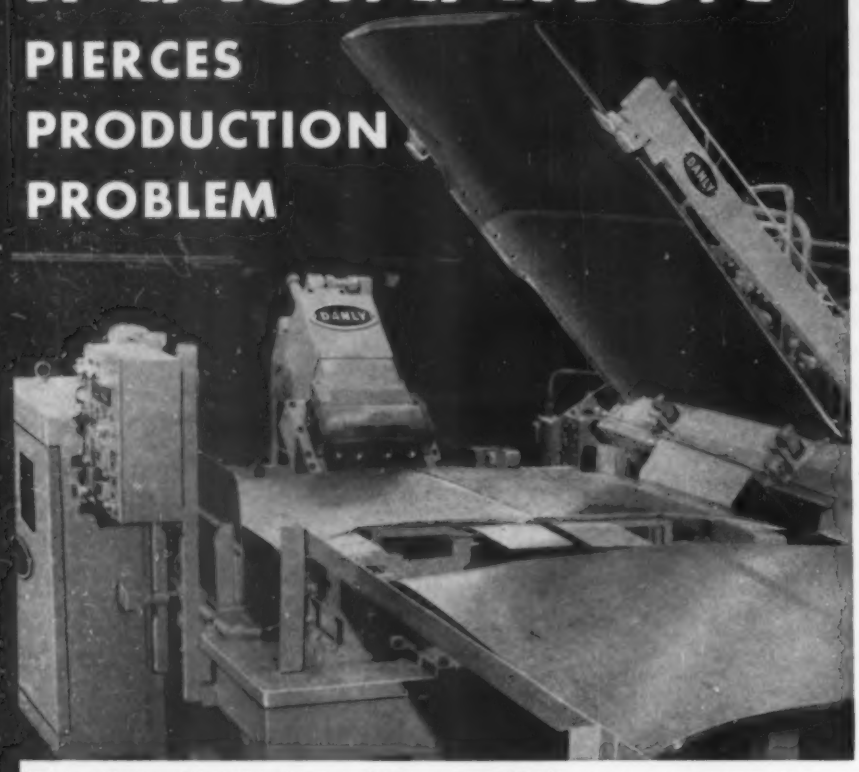

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of the pump, a pump may now be selected from those shown in Table II, p. 109. From Table II, a single-stage (4-and-4 by 2¾) pump is rated as having a piston displacement of 32 cu.ft./min., which is essentially the same as the calculated piston displacement of 31.2 cu.ft./min. required. However, it must be remembered that leakage losses, provision for pre-blow operation, and flow or friction losses are not accounted for in the above calculation. For this reason and to provide for greater operating flexibility it would probably be wise to select a pump with a larger piston displacement, such as the 5-and-5 by 3½ pump which has a displacement of 60 cu.ft./min., in spite of the higher initial cost.

Higher vacuums

There are many types of vacuum-producing equipment to choose from, as illustrated in Fig. 4, p. 109. The vast majority of thermoforming operations can be accomplished with what is called medium vacuum—between 0.5 and 1 p.s.i.a. Single-stage or two-stage reciprocating pumps and two-stage steam-jet ejectors cover the range of medium vacuums. The choice between the two is obvious. Steam-jet ejectors are practical only when a large, inexpensive supply of steam is available. All that is required to run an electric-motor-driven reciprocating vacuum pump is the proper electrical supply.

A single-stage vacuum pump such as the one manufactured by Ingersoll-Rand will pull a vacuum to within 1-in. of barometer or 0.48 p.s.i.a. However, with two stages, these same units will pull a vacuum to within 0.35-in. of barometer, or 0.18 p.s.i.a. To obtain the higher vacuum, you must necessarily sacrifice pumping capacity. In two-staging a two-cylinder pump, the piston displacement is cut in half as listed in Table II. Two-staging a three-cylinder pump reduces the piston displacement only one-third.

System leakage becomes even more important at higher vacuums. When you compound, or two-stage, a pump, your system must be absolutely tight. At high vacuums, even the slightest leak will make it virtually impossible to maintain the lower pressures.—**End**

Brittleness

(From pp. 125-132)

tion pressures of 10,000, 15,000, and 20,000 p.s.i. and the brittle-ductile division was found for each pressure. The results of these tests are shown in Fig. 5, p. 126. The points are plotted in Fig. 3 as a dotted line and are a line of constant density. The brittle-ductile division is thus found to occur at a definite density or, more correctly, a definite crystalline content for this material. Fig. 5 also shows the variations in molding conditions necessary to obtain this constant density. The increase in molding temperature which was necessary to produce this crystalline content when the pressure was increased points out the interdependency of pressure and temperature on the final crystalline content obtained. To obtain similar crystalline contents, a higher mold temperature was required to overcome the increase in viscosity caused by hydrostatic pressure.

Three other Phillips-type materials were also molded and their densities checked.

Fig. 6, p. 128, shows the density variation with mold temperatures for four PE resins of differing melt index at a constant 5000-p.s.i. molding pressure. Melt indices used were 21, 8, 3, and 0.6. Assuming molecular weight is inversely proportional to melt index, increased chain length is found to decrease the crystalline content slightly. This may be attributed to increased chain entanglement and increased melt viscosity.

Fig. 7, p. 128, shows stress-strain curves of three different molecular weight materials molded at the same pressure and temperature. Mold temperature was 250° F. and pressure was 5000 p.s.i., which places both the 21- and 8-melt-index materials in the brittle range and the 3-melt-index material in the ductile range.

The brittle-ductile division lines for these three materials are shown in Fig. 8, p. 128. All three respond similarly to increasing pressure. Note that higher mold temperatures or slower cooling is required to induce brittleness in the higher-molecular-weight materials.

Similar runs were made using Ziegler linear PE containing a

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slightly higher degree of branching. Fig. 9, p. 130, shows density of a 4-melt-index Ziegler resin as a function of mold temperature and injection pressure. As expected, branching hinders crystallization and all density values at comparable molding conditions are below those of the less-branched Phillips Process material (see Fig. 3). The density range is also much narrower, indicating a lower sensitivity to changes in molding conditions. This may be due to increased branching, which prohibits a high degree of crystallinity even with slow cooling and long crystallization periods. Increasing molding pressure also decreases density.

Stress-strain data taken on samples of various densities within this range, are shown in Fig. 10, p. 130. Molding pressure was constant at 5000 p.s.i.; mold temperature was varied to obtain the differing densities. The 0.9465-density material exhibits the expected elastic deformation followed by the yield point and ductile plateau. As density increases, yield point decreases slightly while elongation decreases rapidly. A marked change occurred in this trend as the density exceeded 0.9520. A brittle-ductile division did not occur; apparently a structural change can be introduced by continuing to decrease crystallization rate. The yield point reverses its trend and increases as density increases above 0.9520; elongation also increases. Although densities of 0.9522 and 0.9525 are of the same magnitude, the mold temperature difference between samples was 40° F., which represents a large change in cooling rate. It is interesting to note that as the Ziegler resin's density is increased by fabrication techniques, the shape of the stress-strain curve approximates that of the less-branched Phillips material.

Three other Ziegler type materials of higher molecular weight were also molded at 5000 p.s.i. and the density-mold temperature relationship is shown in Fig. 11, p. 132. As with Phillips resin, increasing molecular weight causes a slight density decrease.

Long-term failure

Long-term brittle failure is also important in the engineering and design of PE applications, so stress-

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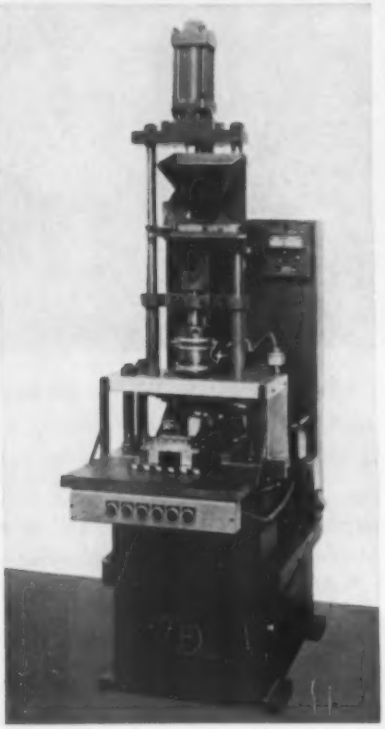

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relaxation tests were run. Igepal CO-630 was put on the specimens just prior to the test. This liquid has been widely used as a standard in environmental stress-cracking tests currently being evaluated by A.S.T.M. sub-committee XV on plastic materials (14). Figure 12, p. 132, shows the relaxation curve of two samples of the 21-melt-index Phillips resin. Samples of differing density were made by varying molding conditions; an obvious difference in the load-carrying time before failure was observed. Time of failure was taken as the point where the relaxation curve diverged markedly from the gradual relaxation curve to be expected if the ductile-to-brittle behavior transition did not occur. The expected gradual relaxation curve (dotted line in Fig. 12) was obtained by testing a 0.9640-density specimen without Igepal. The 0.9642-density specimen begins to deviate after 6 hr., while the 0.9518 sample shows a similar deviation at 12 hr., indicating increased resistance to brittle failure as density decreases. Shortly after this deviation, a visible crack appears on the specimen. In all cases of failure, this crack began in the neck of the sample and grew in a direction perpendicular to the applied stress. Crack propagation continued from the edge to the center of the specimen, where it met a similar crack growing from the opposite edge. In tests performed with 3- and 0.6-melt-index materials, no failures occurred during a 100-hr. maximum time period. Fig. 13, p. 132, shows the results (average of duplicate runs) of a series of stress-relaxation tests run on 21- and 8-melt-index Phillips type resins. Samples of different density were all molded at 5000 p.s.i., using mold temperatures to vary density.

The line for the 21-melt-index resin shows that a definite increase in load resistance time occurs as density decreases. As density was reduced from 0.964 to 0.952 by varying mold temperature, time to fail doubled, going from 6 to 12 hours. When the same test was run on 8-melt-index resin, a similar increase was noted as density decreased. The expected increase in long-time brittle failure resistance due to lowering melt index (higher molecular weight) also shows up in the shift of the 8-melt-index curve to the right.

Fig. 14, p. 132, shows the effect of molding pressure on the resistance of the 21-melt-index resin to long-time brittle failure. Material molded at 5000 p.s.i. compared with the 15,000 p.s.i. curve shows greater resistance to long-time failure at higher pressure, especially at higher density. This seems to repute the idea that low crystalline content is desirable for resistance to long-time brittle failure. If, however, high hydrostatic pressure during molding introduces a smaller crystallite structure, which more closely resembled that structure expected from higher-molecular-weight materials, such an increase would be expected. This evidence further confirms the hypothesis that as crystallite size decreases it is more likely that even short-chain molecules will pass through several crystallites, thereby linking them into a considerably stronger structure.

Discussion

The tensile properties of linear PE have been shown to vary considerably as density is changed by variations in molding conditions. Understanding this relationship between tensile properties and crystalline content, and the relationship between the crystalline content and molding conditions, is the key to improving part properties through molding technique.

As shown in Figs. 4 and 10, the ultimate elongation of both Phillips- and Ziegler-type materials increased as density decreased. Also, from Fig. 13, the resistance to long-time brittle failure improved at lower density. This indicates that resistance to both long- and short-time brittle failure can generally be increased by decreasing the crystalline content.

That control of crystalline content is possible by controlling molding conditions, is substantiated by data in Figs. 4 and 10, where decreased density and crystalline content were obtained by controlling mold temperature and pressure. Decreasing mold temperature increased the material cooling rate and reduced the final crystalline content. While specific values of density vs. molding conditions are shown, they are applicable only for

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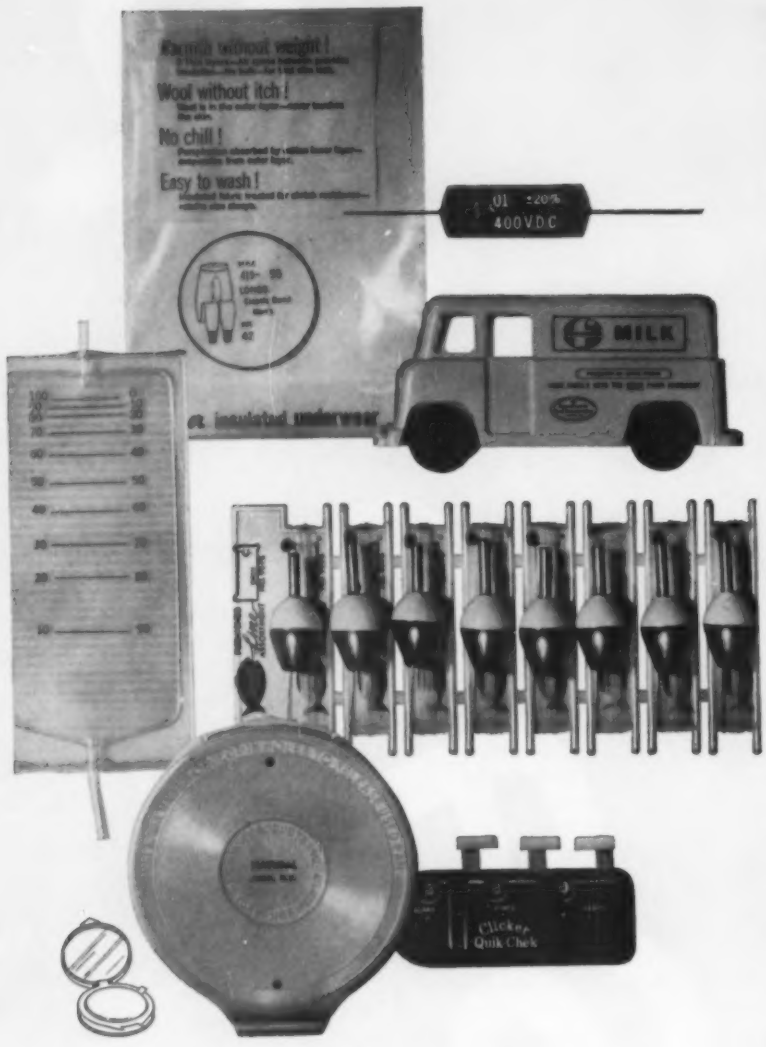

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the specimen molded in this study. It must be remembered that cooling rate will also be affected by the thickness of the polymer section. Heat transfer rates in other molds will depend on the geometry of the polymer section involved.

A second mechanism which improves resistance to brittle failure appears to exist in Ziegler material (Fig. 10) and is developed at very high mold temperatures. Of course, using a hot mold would require a long cooling cycle which would be economically unacceptable. Fortunately, similar results can be obtained using a very fast cooling cycle. Also, greatly improved resistance to long-time brittle failure is possible in Phillips-type material molded at high pressures and slow cooling rate. Since very few molders would be willing to run long cycles, obtaining improved resistance through fast cooling at lower pressures is the more practical approach to this problem.

On the other hand, Fig. 14 definitely indicates that a marked improvement in resistance to brittle failure can be had in low-molecular-weight linear PE by using molding conditions to induce a high degree of crystallinity and small crystallite size. Slow cooling at high pressure produces a structure which has a much longer resistance to brittle fracture than a polyethylene resin of similar density molded at lower pressure.

This indicates that density (or degree of crystallinity) in itself is not an absolutely reliable indication of resistance to brittle fracture. It must also be concluded from both the short-time tensile tests and the stress-relaxation tests that conditioning specimens by annealing before testing for stress-cracking can result in an inaccurate evaluation of material's ability to perform in the "as molded" (use) condition.

Conclusions

1. The crystalline content obtained in molded linear PE will be influenced by mold temperature and pressure applied during cooling of the melt.

2. Increased hydrostatic dwell pressure during crystallization will decrease the final polymer density unless mold temperature compensation is used.

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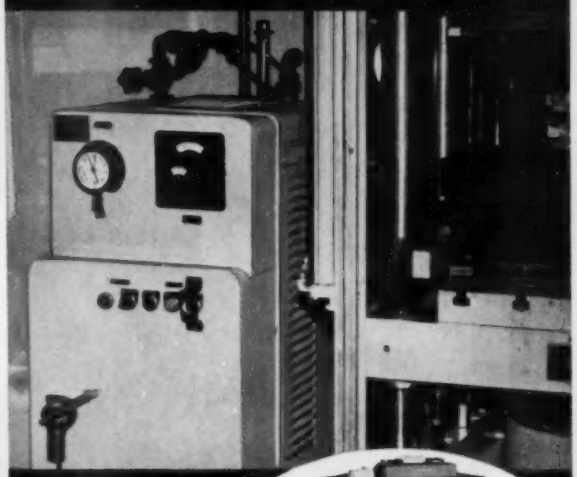

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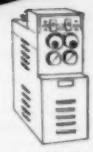

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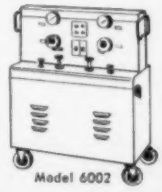

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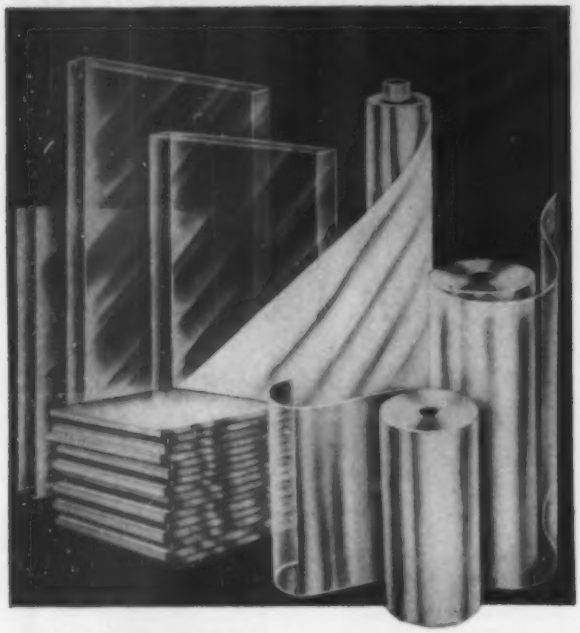

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ene crystallinity will affect both the long- and the short-time tensile properties.

4. Molding conditions can be effectively varied to produce brittle or ductile behavior in various types of polyethylene with differing molecular weights.

5. The interrelation of polymer structural variables, such as molecular weight and degree of branching, and molding variables of pressure and mold temperature must be considered in the evaluation of the brittle-ductile behavior transition.

6. It is possible to produce long-time resistance to brittle fracture in low-molecular-weight linear polyethylene by proper control of pressure and mold temperature during the cooling process.

References

1. J. B. DeCoste, F. S. Main, and V. T. Wallder, Industrial and Engineering Chem. *43*, 117-121 (1951).

2. F. H. McTigue, Plastics Technology *5*, 35-39, (1959).

3. J. B. Howard, Technical Papers of the Society of Plastics Engineers *5*, 62, (1959).

4. W. W. Spohn and H. T. Frey, Jr., A.I.E.E. Winter Meeting (N.Y.C.), Jan. 1957.

5. R. B. Richards, J. Applied Chem. (London) *1*, 370-376, (1951).

6. G. Kafavian, J. Polymer Sci. *24*, 499-501 (1957).

7. Report of Committee D-20, A.S.T.M. Annual Meeting, Jan. 1959.

8. A.S.T.M. Designation: D1248-58T, issued 1952, revised 1958.

9. P. H. Till, J. Polymer Sci. *24*, 301 (1957).

10. W. M. D. Bryant, Journal of Polymer Science *2*, 347 (1947).

11. Shiro Matsuoka and Bryce Maxwell, J. Polymer Sci. *32*, 131 (1958).

12. Bryce Maxwell and Alex Jung, Modern Plastics *35*, 174, Dec. 1957.

13. K. A. Kaufmann, Modern Plastics *36*, 146, April 1959.

14. R. L. Collins, J. Polymer Sci. *27*, 75 (1958).

15. I. L. Hopkins, W. O. Baker, and J. B. Howard, J. Applied Physics *21*, 206-213 (1950).—**End**

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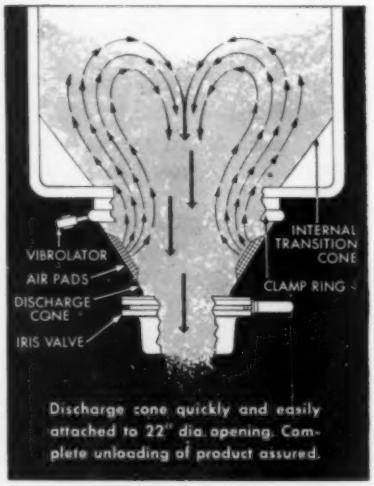

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Plastisol foam

(From pp. 135-145)

pounds containing relatively large plasticizer concentrations. As a consequence softness of hand can be accomplished without the tackiness of high plasticizer levels. Another benefit from the use of small quantities of blowing agent in fabric coating is the reduction in the weight of coating necessary for a specified gage. Although the coating weight may be reduced by a third with no loss in gage, the product, with only very modest quantities of blowing agent required (about 0.25%), does not lose its essentially solid construction. The cells can be detected only upon very careful examination with suitable magnification.

Foam plastisol sprayed onto metal folding chair seats could provide an inexpensive cushioning material following the exact contour of the seat. In the construction field vinyl foam could be utilized as a fireproof insulating material when applied to metal and non-metal construction panels. Other areas where either partially or completely foamed vinyl plastisol products may be of interest are in floor and wall coverings and possibly coated synthetic and natural yarns producing woven fabrics of unusual constructions.

Much work remains to be done in the area of plastisol foam. The effect of various pigments, activators, and other formulating ingredients on cell quality deserves additional study. The physical properties of the foams produced under the wide variety of formulation variables have yet to be examined. A far more definitive study of the relationship between hot melt viscosity and foam quality may eventually yield a set of precise Mooney viscosity values for use in formulating plastisol as well as other types of vinyl foam. Judging by the great activity noted in the field in connection with all types of vinyl foam, we can expect this to be an area of continuing growth for the vinyl industry.

The helpful counsel of Ivan Mankowich, Manager, Marvinol Development Section of the Naugatuck Chemical Co., as well as other members of the Section is gratefully acknowledged.—**End**

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In a world where the political climate for global business enterprises is often stormy, many U.S. manufacturers have discovered a way to extend their operations overseas and bring back profits with a minimum of risk to their capital.

[illegible],000 Contracts

The rate at which licensing agreements were set up in the first quarter of 1961 was 20% higher than in the last half of 1960, according to a continuing study of 3,000 firms by Booz, Allen & Hamilton, Chicago-based management consultants. Government figures indicate that royalties to U.S. firms from foreign licensees, at last count in 1959, totaled $515 million, 43% more than in 1958 when they were $361 million. More than 12,000 licensing arrangements are now in effect, roughly double the number in 1945.

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Moldable urethanes

(From pp. 146-152)

does not contain any inert filler or extractable softener that would act to reduce the apparent degree of volume change.

In spite of its thermoplastic nature, the new polymer retains a relatively high level of stress-strain properties in the 175 to 200°F. operating temperature (see Table V). Although the polyurethanes show the largest percentage decrease in strength, the 574OX1-type still retains a tensile strength equivalent to nitrile and polychloroprene compounds and the tensile strength of the 574OX7-type is more than twice as high as that of the special-purpose rubbers in this temperature range. In view of its higher modulus value, the 574OX7-type is preferred for high-temperature service.

At low-temperature operating conditions, the flexibility of the polyurethane falls between the values for natural and nitrile rubber when compared by the Gehman torsional method (3), as shown in Fig. 2, p. 148.

Solution applications

Because of its completely reacted nature and its solubility characteristics, Estane provides a new method of applying polyurethane coatings. Unlike the conventional isocyanate-polyester two-package systems which must be kept separate until coating application time, the new polymer may be made into a solution with unlimited shelf and pot life. Although neither is a highly soluble polymer, 574OX1 can be dissolved in tetrahydrofuran, dioxane, cyclohexanone, and dimethyl formamide (Fig. 3, p. 148, shows its solubility characteristics in some of these solvents) and 574OX7 is soluble in dimethyl formamide only.

Estane 574OX2 was developed for applications where greater solubility and the use of less-expensive solvents (such as acetone and methyl ethyl ketone) are required, although it is also dissolved by the strongly solvating solvents used with 574OX1. When dissolved in acetone or methyl ethyl ketone, 574OX2 may be thinned with non-solvents such as benzene (4). Its solubility curves in acetone, methyl

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CLAMPING FORCE(U.S.t)		84	195	310	480	850	1250	2500
SPACE BETWEEN TIE BARS (in.)	H	10 1/4	14 3/16	18	26 3/16	39 3/8	48 1/2	54
	V	6 5/16	11	16	22 1/4	35 7/16	40 1/2	54

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ethyl ketone, and acetone reduced with benzene are shown by the graph in Fig. 4, p. 148.

Typical solution applications for the new polyurethanes are in cements, migration barriers, impact- and abrasion-resistant lacquers, and top coats. An example of the increase in abrasion resistance that may be imparted by applying such top coatings to cotton twill fabric is shown by the tabulation in Table VII, p. 152.

Many fabrics and materials like cotton do not require any primer, but cured rubber and metallic substrates usually do. In the cotton coatings described, the coating characteristics of the 25% solutions were such that no strike-through occurred. However, the rheological properties of Estane solutions may need to be modified for coating other substrates. Rheological properties may be altered radically by the addition of a carboxy polymethylene thickener (5) to provide considerable flexibility in developing satisfactory coating characteristics. Table VIII, p. 152, contains an effective formulation that is used for thickening by this particular method.

Although the thickening procedure is simple and requires only a Lightnin- or Epenbach-type mixer, the sequence of additions is critical. After the polyurethane is dissolved in a 50/50 solvent blend of tetrahydrofuran and dimethyl formamide, the Carbopol is added slowly with as much agitation as possible. After the Carbopol is completely dispersed, an equivalent amount of di-2-ethyl-hexylamine is added with continued agitation. The solution will remain relatively fluid after this addition, but will be thickened by adding the water as quickly as possible with the maximum amount of agitation.

Hose and jacketing

The advantage of the new polymer in hose and jacketing applications is its combination of low-temperature flexibility, toughness, and resistance to cuts, ozone, oils, fuels, and abrasion. This combination surpasses any of the thermoplastic or thermosetting materials commonly used while retaining all the advantages of thermoplastic processing. The thermoplastic polyurethane has found many applications in wire and cable jacketing, although its electrical properties (see Table IX, p. 152), are not adequate for use as a primary insulation except in special cases. As is the case with other polyurethanes, the Estane polymers support combustion, but they can be made self-extinguishing by simple compounding methods.

References

1. V. L. Hallenbeck, B. F. Goodrich Research Center, unpublished work.
2. V. V. Vickroy, B. F. Goodrich Research Center, unpublished work.
3. S. D. Gehman, D. E. Woodford, and C. S. Wilkinson, Industrial and Engineering Chem. *39*, 1108 (1947).
4. J. C. Taylor, B. F. Goodrich Chemical Co. Development Center, unpublished work.
5. C. E. Mater, B. F. Goodrich Chemical Co. Development Center, unpublished work.—**End**

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THE PLASTISCOPE*

Important news . . . and what it means

By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 37*)

October 1961

Rigid PVC-polystyrene-kraft laminate has interesting potential

Price has long been a major stymie to rigid PVC's full penetration of the chemical processing market. True, there have been quite a few installations of rigid vinyl ductwork, hoods, exhaust systems, etc., but when viewed against the total available market, these installations represent only a fraction of the full potential.

Now a new material, introduced by Kaykor Products Corp., Yardville, N. J., under the trade designation Kaylite, has all the earmarks of broadening vinyl's market area.

What is it? Kaylite is a laminate sandwich consisting of two outer skins of calendered rigid vinyl sheeting (5 to 10 mils thick), and a core of alternating layers of 1-mil oriented polystyrene film and X-crepe paper. All layers are laminated simultaneously on a Rotocure press, the number of layers in the core depending on the desired thickness of the final laminate.

Properties. Several significant advantages are claimed for the material:

1. Light weight: The weight of the material is said to be about one-thirteenth that of steel, one-fourth that of aluminum, and about five-eighths that of rigid vinyl. This characteristic has a bearing on handling ease and strength requirements of supporting structures in ducting installation.

2. Temperature resistance: The laminate is said to offer both higher and lower temperature limits than solid PVC, because the core provides structural strength that is unaffected up to 250° F. However, it should be pointed out that in both flexural and tensile strength at room temperature solid rigid vinyl has considerably higher property values than Kaylite. At 75° F., rigid vinyl has a tensile strength of about 7000 p.s.i., Kaylite about 2000 p.s.i.; rigid vinyl has a flexural strength of about 14,000 p.s.i., Kaylite about 4000. But at 200° F., when rigid vinyl has dropped to about 500 p.s.i. in tensile strength, Kaylite is still said to be around 2000 p.s.i.; and while flexural strength of rigid PVC at 200° F. has fallen to below 1000 p.s.i., Kaylite is still close to 4000 p.s.i. In other respects, Kaylite is said to offer the same chemical-resistant properties as high-impact (Type II) rigid PVC.

The cost picture. In a thickness of ⅛ in., Kaylite costs 65¢/sq. ft. This compares to about 85¢ for solid rigid vinyl of the same thickness. In the ducting field, rigid vinyl reportedly costs about 20% more than insulated galvanized metal ducting; the new material is claimed to be 20% less. Incidentally, as an indication of size of market, about 15% of all air-conditioning ducting is currently made of insulated galvanized metal. In square footage this amounts to 80 to 100 million square feet.

Fabrication. Kaylite is supplied in thicknesses of ⅛, 3/16, and ¼ in., 48 by 96 in. in size, and is available from Kaykor as well as from Ryerson Steel.

Essentially, the material is processed by a combination of plastic and metal fabrication. Since X-crepe is 60% deformable, the laminate can be fabricated into three dimensional objects by pressure forming, plug-and-ring, matched metal molding, and blow molding into a female mold. Vacuum forming cannot be used.

In all cases, it is necessary to cover the exposed open edges of the laminate. A special epoxy-based edge sealer is supplied for this purpose. Joining is almost identical with joining of solid rigid PVC sheeting: hot air welding and use of extruded profiles.

Applications. In addition to ducts, stacks, and hoods, the new material is suggested by the manufacturer for tank covers (can be exposed to boiling temperatures); wall protection in corrosive environments (can be fastened mechanically without surface preparation); pans, trays, machine guards; and chutes and chute liners.

Installations already completed include ducting at M.I.T., wall protection at McDonnell Aircraft, and chemical processing ducting at P&G.

Easy-to-use-epoxy adhesive

What one user calls an "idiot-proof epoxy," has been introduced by Rubber & Asbestos Corp., Bloomfield, N. J. The material, called Bondmaster M666, is an equal-parts-by-volume, two-component system that any workman can mix up and use without fear of error—without metering equipment or scales. Furthermore, at $8/gal., it is said to give the user a lower cost per sq. ft. of completed glue line than can be obtained with Neoprenes.

Bondmaster M666 is a 100%-reactive, room-temperature-curing, undegraded epoxy adhesive which has been formulated for industrial use. It is reported to differ substantially from the conventional highly filled compounds or solvent-dispersed products currently being marketed for household applications. Fully cured metal-to-metal bonds produced with this new product, in tests reported by the company at room temperature using MIL-A-5090B procedures, yield up to 3500 p.s.i. Bonds involving expanded styrene foam withstand 175° F. for 200 hr. without cell attack, the firm reports.

Aside from the lower labor and equipment costs which are expected to result from the use of a 1:1 mix, Bondmaster M666, itself, is reported to be priced at one-third to one-half less than most conventional formulations of equivalent strength.

In addition, since the formulated epoxy adhesive achieves full strength at room temperature without the application of greater pressure than that necessary to keep components in intimate contact during cure, the need for ovens, lamps, nip rolls, and similar capital equipment is eliminated.

Vinyl resins for coating

Two new vinyl solution resins intended for the preparation of product finishes and industrial maintenance coatings are now available from Union Carbide Plastics Co. The resins, Bakelite VYHD and VXCC, are medium-molecular-weight, vinyl chloride-vinyl acetate copolymers. VYHD is unmodified; VXCC is structurally modified to impart metal-adhesion properties. The key property of both resins, according to the company, is their low viscosity in solutions of high solids content, coupled with good toughness, flexibility, and chemical resistance.

The new resins are said to be more soluble in ketones and other solvents which normally dissolve vinyl resins, have higher aromatic tolerances, and yield solutions of **(To page 234)**

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THE PLASTISCOPE

(*From page 232*)

lower viscosities than existing vinyl resins of equal quality. Thus solvent costs can be reduced by increasing the non-volatile content of the formulation and by increasing the ratio of lower-cost aromatic diluents to ketones and other higher-priced solvents. The net result is a savings in applied resin costs that can range from 15 to 25%, the company claims.

Semi-conducting polyethylene

Availability of a semi-conducting high-density ethylene copolymer resin for replacement of fabric shielding on high-voltage cabling has been announced by Du Pont's Polychemicals Dept. It may be applied as an extruded layer or as wrapped tape.

Designated Alathon 2900 BK 50, the material is used primarily as an electrostatic shield on insulated wire for control and communications.

Projected applications include packaging film and extruded or molded parts which must be free of static electricity. One pending use is in a molded case for blasting caps.

The copolymer reportedly resists cracking when bent, despite high carbon content.

Alkyd molding compounds

Two electronic-grade molding materials, Plaskon 541 and 428, have been added by Allied Chemical's Plastics Div. to its line of alkyd molding compounds. AMC-541, based on a diallyl phthalate resin is fibrous glass-reinforced and flame-retardant. It conforms to the new Type GDI-30F of Mil-M-19833.

AMC-428 is said to be a fast-curing, glass-filled granular material featuring stability of dielectrical constant at varying temperatures.

High-density PE resins

Commercial availability of three new types of high-density polyethylene resins has been announced by Hercules Powder Co. The new Hi-fax resins, in the 0.962-density range, are said to produce moldings that are stiff in thin sections without becoming brittle or subject to flex-cracking. The new resins, priced at 32¢/lb. in carload lots, are produced at Hercules' Parlin, N. J. plant, using Ziegler catalysts.

Nylon pressure tubing

A light, strong, flexible tubing which withstands high pressures and is easily installed has been introduced by Garlock Inc., Palmyra, N. Y. Called 9056 Nylon Pressure Tubing, its flexibility is said to eliminate pre-bending and the need for flexible couplings or intermediate fittings.

Performance tests reportedly show that the new tubing resists fatigue, abrasion, impact, most corrosive agents, and withstands temperatures from −40 and 185° F. The company suggests this new product as a "low-cost, rugged tubing for almost any type of hydraulic-pneumatic service." It is said to cost far less than seamless copper, extruded aluminum tubing, welded stainless steel tubing, and seamless steel tubing.

The pressure tubing is available in sizes from ⅛ to ½ in., which provides suitable application for these lines: hydraulic, lubricating, pneumatic, vacuum, air, chemical processing, and caustic and dilute acid.

Primer for plastisol coating of nylon

A new primer, said to provide excellent adhesion of plastisol coatings to nylon fabrics, has been announced by the Angier Adhesives Dept. of Interchemical Corp., Finishes Div., Cambridge, Mass. Known as SBC-2047-1, the adhesive is a two-component system with a pot life of up to 48 hr. after mixing.

The primer may be applied by knife-coating or dipping at a dry film weight of 0.8 to 1.0 oz./sq. yd. It is initially set for 1 min. at 250° F., then cured for 45 sec. at 350° F. The short-term heating at elevated temperatures minimizes shrinkage of the nylon. The plastisol coating may then be applied over the primer at thicknesses ranging from 1 to 20 mils and fused at approximately 360° F.

The primer is also said to show excellent flexibility, resistance to water and high humidity, stability to plasticizer migration, retention of fabric tear strength, and absence of staining in light-colored plastisols.

High-power and fast-action plasticizer

A new plasticizer said to have high-solvating power combined with fast-solvating action has been announced by Union Carbide Chemicals Co. The new product, Flexol Plasticizer RK-1, is primarily aimed at vinyl flooring. In addition, it is said to be an effective plasticizer for vinyl film, vinyl extruded goods, vinyl foam, vinyl copolymer resins, and acrylic lacquers.

Fully resilient, homogeneous vinyl flooring formulated with the new plasticizer has reportedly shown improved resistance to staining from rubber heels, oil-soluble dyes, asphalt, oil, and general traffic. The advantages of low asphalt solvation and low migration to asphalt and rubber minimize the problems encountered through the use of asphalt- or rubber-base adhesives when Flexol RK-1 is used in vinyl-asbestos flooring.

Versatile stabilizer

Addition of 0.5 to 1% by weight of a fatty acid-modified substituted phenol to polyolefins and PVC is claimed to provide protection against decomposition by prolonged exposure to oxygen and ultraviolet light, while at the same time serving as internal lubricant.

This combination anti-oxidant, UV screener-absorber, and plasticizer has been introduced by Guardian Chemical Corp., Long Island City, N. Y., under the tradename Voidox 100%.

The new additive sells at $1.75/lb., in quantity lots. It is supplied in flake form and, according to the company, can be either dry blended with the resin in a ball mill or tumbling operation, or be added in liquid form. Melting point of the flake is 60° C. (140° F.).

Added to film-grade polyethylene, the material is said to improve drape, hand, extrusion rates, and sealability. Voidox is reported to be manufactured from food-grade raw materials and to have obtained FDA approval as a direct food additive in concentrations up to 0.02 percent. And it is presumed by the company that films and containers made from resins incorporating Voidox 100% will have FDA clearance, since degree of leaching is negligible.

Guardian Chemical has doubled production capacity for Voidox twice within the past 12 months. Current capacity is 300,000 lb. per year.

Epoxy curing agent

Commercial availability of a group of new liquid polyamide curing agents for epoxies has been announced by Heyden Chemical Div., Heyden Newport Chemical Corp. Identified as Pentamid 1 and 2, they are primarily intended for use with coating, tooling, and adhesive resins. When cured, the resin-catalyst systems are said to possess flexibility; good adhesion; high mechanical strengths; resistance to solvents, chemicals, and water; and ease of handling.

Wax mold release

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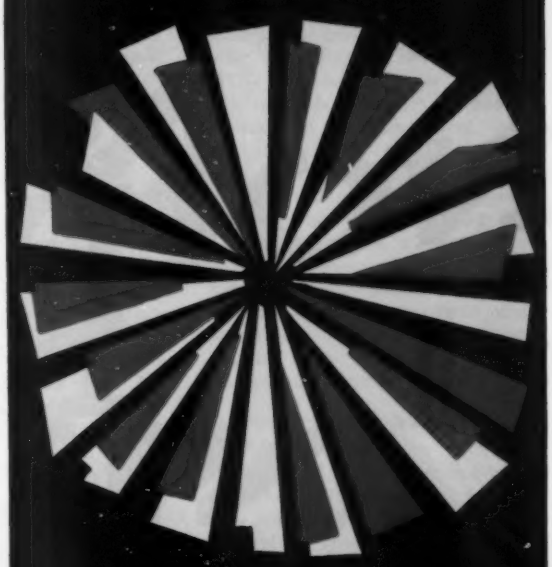

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THE PLASTISCOPE

(*From page 234*)

and rigid vinyls, has been introduced by Advance Solvents & Chemical, New Brunswick, N. J. Called Advawax 280-F, it comes in finely powdered form (100 mesh) and has a melting range of from 280 to 290° F. It reportedly reduces roll sticking and minimizes frictional heat build-up in calendering and extrusion. The wax remains in a fine suspension within the plastic; and during extrusion, calendering, or molding it migrates to the surface, providing a smooth gloss, the company states.

Polymeric plasticizer

Wilson-Martin, Philadelphia, Pa., Div. of Wilson & Co. Inc., has completed an expansion of its chemical derivative plant facilities and is marketing a new plasticizer called Wilmar Polymeric Plasticizer W-64. Claimed to be a true, primary polymeric plasticizer, the new product is said to have low-odor, low-temperature properties, medium weight (3500) and low migration, and is recommended for such applications as a permanent plasticizer in refrigerator gaskets, surgical tape, hospital sheeting, foam, shoe liners, wall coverings, and general-purpose vinyl film. Its compatibility with polyvinyl chloride and its electrical properties are said to make it suitable for use in electrical insulation and tapes.

Frozen adhesive

Epoxy adhesive—catalyzed, bubble-free, and prepackaged in gram capsules and frozen by the manufacturer is solving problems in the bonding of the highly precise equipment for inertial guidance of missiles which is produced by Autonetics Div., North American Aviation Inc., Downey, Calif. This effective concept in adhesive preparation and packaging is reported to have eliminated improper in-plant mixing of resin and curing agent, material waste, as well as air-entrapment.

Batches of resin and curing agent are measured out and mixed mechanically and subsequently the catalyzed adhesive is extruded in small amounts into plastic or metal containers and immediately brought down to a temperature between —80 and —90° F. The frozen epoxy is packed in dry ice and shipped to Autonetics where it is placed in a freezer until ready for use. Shelf life is said to be four weeks when stored at —40° F. To use the material, the adhesive is removed from the freezer and "thawed out." It takes about 3 to 5 min. at room temperature (about 60 sec. at body temperature) per gram to defrost the adhesive. Application is then standard. The adhesive is supplied by Shell Chemical Co., Pittsburg, Calif.

Acetal strip

Delrin 150 acetal in strip form for use in punched parts such as gaskets, washers, closure liners, etc., is now available from A. L. Hyde Co., Grenloch, N. J., already a supplier of Delrin rod and slab. The smooth, hard, glossy surface of the thermoplastic, somewhat slippery to the touch, has a low coefficient of friction even in the unlubricated state. The coefficient remains virtually unchanged over a wide range of temperatures, bearing loads, and relative surface speeds.

Delrin strip is supplied in coils in thicknesses from 0.020 to 0.070 in., and widths of 2, 4, 6, and 8 inches.

PVC packaging film

A polyvinyl chloride elastomeric packaging film is now being produced by The Borden Chemical Co. at its North Andover, Mass., plant. The film is being sold as Resinite VF-70 at 69¢ per pound. One pound yields 28,700 sq. in. of film at 0.00075 gage. Special properties of the film listed by the company are brilliant surface, unusual clarity, non-fogging, and excellent heat sealability. The film is used primarily at the retail level to repackage goods received in bulk for display on the counter in individual bags. Supermarkets are principal users up to now, with fresh fruit and vegetables the first items so packaged. The film is consistent with current government regulations for food applications, the company states.

Endless polyester belts

Oriented Mylar film is now available in endless belts for power transmission, conveying, and instrumentation from International Ultrasonics Inc., Cranford, N. J. Using ultrasonic equipment to produce smoothly-running splices, the company claims joint strengths of 90 to 100% of that of the original material.

International offers belts of Mylar in any length, in widths from ¼ in. to 60 in., and in thickness from 1 to 10 mils or more; and belts of Cronar oriented polyester photographic film with standard perforations, in widths from 16 to 70 mm. and thickness of 4 or 7.5 mils. The company states it will also form endless belts from customer-provided strips having special perforations, magnetic oxide coatings, photograph emulsions, etc. Overlap is a maximum of 0.050 in. ±0.001, and thickness of the joint is said not to exceed thickness of the material by more than 10 percent. Thickness variation can be held to ±1% on special order, according to the firm.

The company says its ultrasonic splicing method requires no heat or cement, and no featheredging, tapering, scraping of coatings, or other special end preparation. Pin feed registration and micrometer alignment are used for end positioning. The overlapped ends are traversed by an ultrasonic vibrating horn which transmits energy through the polyester in such a way that the surfaces to be joined adhere positively without application of more than mild clamping pressure, the company states.

Electrostatically treated PE-coated paper

Polyethylene-coated paper and board, electrostatically treated, is now available from Plastic Papers Inc., Hicksville, N. Y. This treatment, according to the company, makes it possible for bag, sack, carton, and box manufacturers to convert polyethylene-coated papers, using standard paper adhesives. This not only eliminates the high cost of special PE adhesives, but also eliminates down time in setting up converting equipment for special runs, the company claims.

Sand-resin molds

Development of a low-cost method for producing molds and models has been announced by Hysol Corp., Olean, N. Y. Called the epoxy-sand technique, it utilizes Hysol tooling materials combined with dry silica sand to provide tough, dimensionally stable molds and models which, the company states, cost less, on a material and labor basis, than plaster. According to the company, the necessity of drying and sealing the sand mold is eliminated—it is ready to use in 2 to 4 hr.—and molds will not crack, peel, or chip.

PVAc price lowered

Vinac RP-250, a spray-dried polyvinyl acetate manufactured by Air Reduction Chemical & Carbide Co., Cleveland, Ohio, is now selling at 45¢/lb. in truckload quantities. The former price was 47 cents. Prices on the West Coast are an additional 1½¢ per pound.

The material is used principally in the formulation of concrete ready-mixes, joint cements, dry-mix paints,

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and spackling compounds. Formulations with Vinac RP-250 are said to have excellent adhesion, lower water demand, and less shrinkage than casein-type cements. Standard containers for Vinac spray-dried powders are 55-gal. drums, and the net weight is 200 pounds.

Epoxies for filament winding

Two new epoxy resins for filament winding systems have been developed by Union Carbide Plastics Co. Designated Bakelite ERL-2256 and ERL-2258, they are said to have high tensile elongation and good handling characteristics that make them suitable not only for filament winding but also for laminating applications. ERL-2256 is especially recommended for both wet lay-up and bag molding.

The new resins cure well with anhydrides and aromatic amines at room temperature but are not recommended for use with methyl nadic anhydride, the company states.

ERL-2256 has a viscosity range of 500 to 900 cps. at room temperature, and ERL-2258, especially developed for filament winders requiring ultra-low viscosity, has a range of 100 to 500 cps. at that temperature.

Conductive adhesive and sealant

Production of a moderately priced conductive epoxy that is said to open many new application possibilities has been announced by Conap Inc., Allegany, N. Y. Designated Conap 1225, the resin is filled with silver and when cured yields a volume resistivity of 0.01 ohm-cm. at 25° C. To increase versatility three hardeners are offered: one for curing at room temperature, one to provide long pot life, and one for operation at elevated temperatures. Water absorption after 24 hr. is reported to be 0.1% and shrinkage during cure 0.15 percent. The mixed material is a smooth, easy-to-apply paste. A kit containing 1 lb. of Conap 1225 and Hardener 02 is suggested for initial testing and limited production. The price is $15, f.o.b. Allegany, N. Y.

PE ice bags

A variety of polyethylene bag constructions to replace the standard single-wall, wet-strength paper types used in the growing ice cube vending machine industry are now being fabricated by the plastic package plants of Bemis Bro. Bag Co., in Terre Haute, Ind., and Union City, Calif. Advantages of the PE bag, according to the company, include moisture resistance; package compactness; substantial reduction in initial cost of the package; an inherent sanitary implication of a clear package; and reuse for storage of food products. In addition, polyethylene is leakproof, can be heat-sealed to prevent contamination, and will not stain or result in fiber separation when exposed to room temperature, a common difficulty in paper saturated with melting ice. Bags for ice cubes can be fabricated with or without drawcord, imprinted or unprinted, and for heat-sealed or twist-and-tie closures.

Powdered polyester resin

A monomer-free, unsaturated isophthalic polyester powder is available from Commercial Resins Corp., St. Paul, Minn. Called CoRezyn 2, this new form is said to give fast solution in styrene monomer to produce an isophthalic polyester resin with excellent adhesion to fibrous glass reinforcement. The material is packaged in 50-lb. multiwall kraft bags which can be stacked in a small area, and stability problems are eliminated since the powder is reportedly stable indefinitely until dissolved in styrene.

In addition to use in reinforced plastics processing, CoRezyn 2 is also suggested by the company as a thermoplastic modifier in adhesives, coatings, and rubber compounding.

Non-flammable cement for foams

Designed for polyurethane bonding applications, Non-Flam, is a foam-fabricating adhesive marketed by Imperial Adhesives Inc., Cincinnati, Ohio, and said to be non-flammable. Besides eliminating the danger of flash fires, Non-Flam is said to dry fast, transparent, and with a soft tight seam that has no depression.

Rigid PVC pipe

A new line of rigid PVC electrical conduit, developed for use underground or encased in cement, has been introduced by Lasco Industries, Montebello, Calif. The line includes pipe, elbows, couplings, and adapters, ranging in size from ½ to 6 in. in diameter. The series is said to have been approved and listed for underground application by UL.

The pipe is extruded in 10-ft. lengths with one end coupled. Each length is dated, tested, and its test history noted for reference by customers under the company's quality control system. The new conduit is expected to find application in concrete slab floors, in harbor areas where underground conduit is subject to salt water corrosion, and in residential developments.

Plastisol spray facilities

Installation of complete custom facilities for the spray application of plastisol coatings to large industrial tanks and equipment has been announced by the G-N Equipment Co., Grand Rapids, Mich. The fusing oven measures 40 by 10 by 12 feet.

Urethane wood sealer

A clear urethane finish, claimed to effectively seal the wood surface of glue-laminated beams with one coat, has been announced by Canadian Elastileum Ltd., Vancouver, B. C.

The new finish, Elastileum 100, is a two-package system. Equal amounts of parts 1 and 2 are mixed prior to application. Pot life of the prepared mixture is 24 hr. maximum.

Elastileum 100 coatings and other urethane finishes will be produced and marketed in the U. S. by a newly set up subsidiary, Elastileum Inc., in Los Angeles, Calif.

Skin packaging PE film

A 3-mil pressure-sensitive polyethylene type film, specially formulated for skin packaging, has been introduced by the Flexible Packaging Div. of Continental Can Co. The material is said to provide excellent adhesion to uncoated board, proper drawdown and forming characteristics, strength, gloss, and transparency. It is also said to offer the user significant savings in materials' costs.

The skin packaging film was developed specifically to bond to fibrous surfaces and, according to the company, has been tested successfully on plain chipboard, white patent-lined chipboard, white lined kraft, patent-coated news back, wood vat-lined news back, and double-faced corrugated board. Applications include auto parts and accessories, cutlery, drugs and cosmetics, electrical and electronic parts, notions, etc. It cannot be used for paper or textile products. Extremely heat-sensitive products must be shielded during the sealing cycle, the company states.

Metallic coating for PS foam

A brilliant and reportedly non-inflammable metallic coating for expanded polystyrene foam has been developed by Adhesive Products Corp., New York, N. Y. Designated Styro-Kote, it can be applied by spray, brush, or

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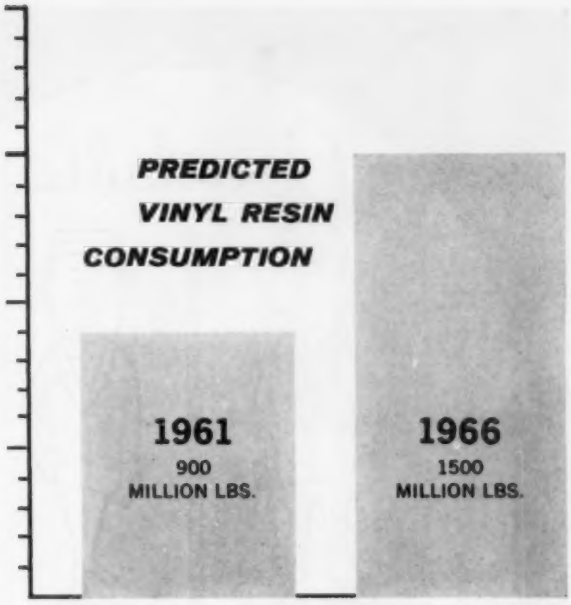

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Write for Data Sheet or Consult Chemical Materials Catalog Page 179 for further data.

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THE PLASTISCOPE

(*From page 238*)

roller to form a flexible, colored metallic skin. Prime market targets are picnic jugs, coolers, flower boxes, etc. The coating is available in aluminum, gold, and metallic red, blue, green and yellow, in 55-gal. drums and in 1- and 5-gal. containers.

MC nylon distributor

Monomer cast (MC) nylon tubular bar, rod, and plate forms produced by Polymer Corp., Reading, Pa., are now being stocked by all seven Eastern Seaboard warehouses of Commercial Plastics & Supply Corp. MC nylon plate can be purchased in standard thicknesses of ½ in. through 4-in., in 2-ft. widths and 4-ft. lengths.

Filament-wound parts

Filament-wound reinforced plastic parts are now offered by Taylor Fibre Co., Norristown, Pa. The parts can be provided in straight tubes, closed-end pressure vessels, and in tapered or other geometrical shapes. They can be furnished in almost any size required in military or industry applications.

First used in aircraft and missile applications, filament-wound laminated plastic is finding increased acceptance as a means for producing strong structural shapes for industrial and military uses. The excellent electrical insulating properties of filament-wound parts make them particularly attractive for electrical applications such as fuse tubes and similar switchgear components and booms for utility workers on high power lines. Other present and potential applications include storage and processing equipment, pressure piping, pressure relief equipment, and centrifugal baskets.

New markets for laminates

Vertical surfaces in commercial buildings represent the newest market area for decorative laminates, according to Howard W. Grosh, product sales manager for the Micarta Div., Westinghouse Electric Corp.

Operators of apartment houses, hotels, motels, schools, and other commercial and institutional buildings are finding them the most economical material available for wall applications, said Mr. Grosh. He cited the following new developments to meet the "new demands."

1. New 1/32-in. laminate for vertical surfacing of kitchen and storage cabinets, furniture and walls. Standard laminate is 1/16-in. thick.
2. New fire-resistant laminate, with

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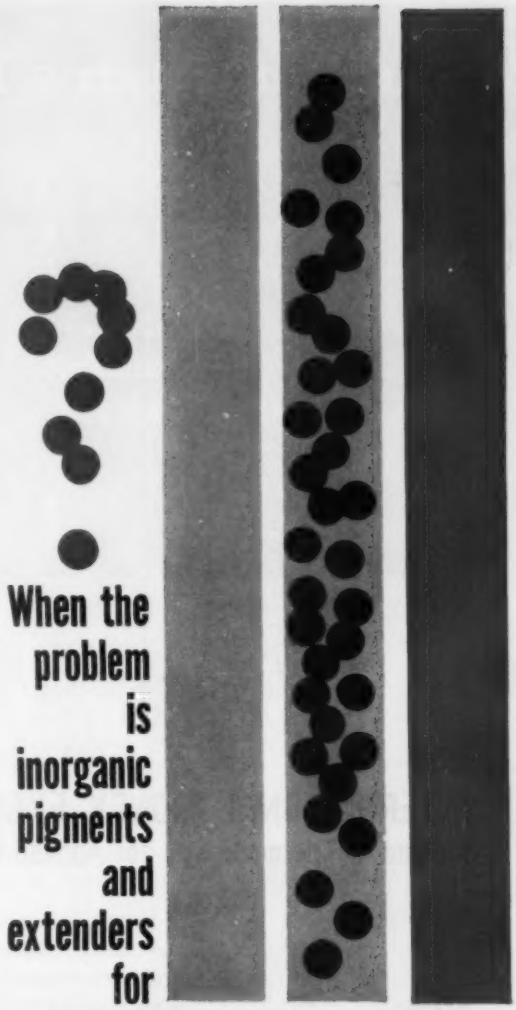

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THE PLASTISCOPE

(*From page 240*)

a base that includes asbestos. Mr. Grosh described this product as "the only high-pressure laminate that is currently available with the Underwriters' Laboratories label."

3. New Lo-Glare finish for office desks, furniture, table tops, wall paneling, and other applications where reflectivity is a prime factor.

A partition panel for office partitions, dividers in reception rooms, washroom separators, and other institutional, commercial, and residential uses is announced by the Micarta Div. of Westinghouse Electric.

The panels consist of Styrofoam (Dow) core with surfacing of decorative laminate. The sandwich is made by gluing 1/16-in. Micarta to both sides of the core. It is trimmed after gluing to remove the glue bead and square the edges. The partitions are simple to install and adjust, with custom cutting at the site of installation. The panel with Styrofoam core is recommended especially for any off-the-floor application. Weight of a panel 1¾ in. thick is about 2.25 lb. per sq. foot.

Another panel, chipboard core, is recommended for any floor-to-ceiling application. Weight of this panel, 1¾-in. thick, is 4.78 lb. per sq. foot.

Expansion

Koppers Co. Inc. has dedicated a new research center at Monroeville, Pa. Erected on a 176-acre site at a cost of $8.5 million, the new facility will house the basic research operations of all the company's divisions, including that of the Plastics Div. About one-third of the structures planned for the center have been completed. When all construction is finished, about 1500 research people are expected to be employed at that site.

Most of the research activity conducted earlier at the Verona installation has been transferred to the new location. Verona will now concentrate mostly on pilot plant work. Activities at the Kobuta plant, devoted primarily to plastics customer service, will remain unchanged.

According to Koppers' spokesmen, plastics research effort at the new installation will be directed primarily to development of new polymers as well as the improvement of properties of existing ones.

Catalin Corp. of America has acquired all the assets of **Lebec Chemical Corp.**, Paramount, Calif. Lebec manufactures a variety of synthetic

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(*From page 243*)

resins which fit in with Catalin's urea, phenolic, cresylic, resorcinol, melamine, and acrylic resins produced in its three existing plants at Fords, N. J.; Calumet City, Ill.; and Thomasville, N. C. This fourth facility is expected to strengthen Catalin's competitive position on the Pacific Coast. **John C. Plummer,** president of Lebec, was elected a director as well as a vice president of Catalin Corp.

The Borden Chemical Co. has completed two new chemical plants, one in Pilar, Argentina, and the other in Cali, Colombia.

The Cali operation, an addition to the existing facilities of Cia. Quimica Borden S.A., is designed to produce 6.6 million lb. of resins of the urea, phenolic, and resorcinol types, and 13 million lb. of formaldehyde annually. The Pilar plant, an addition to Cia. Casco S.A.I.C., will produce substantially the same products and quantities. The new Latin American plants are operated under the direction of Borden Chemical's International Div.

Texaco Inc. has announced plans to build a new multi-million-dollar naphthalene plant with a production capacity of 100 million lb. per year at its refinery in Port Arthur, Texas. Naphthalene is used for making phthalic anhydride, a key ingredient in the production of plasticizers, polyester resins, surface coatings, etc. The new plant is scheduled to go on stream by or before 1963.

Burton Mfg. Co., Northridge, Calif., has acquired **Technical Plastics Inc.,** San Mateo, Calif., which will operate as a division of Burton. Burton Mfg. produces electronic components for aircraft and space vehicle instrumentation, and medical equipment. To these, Technical Plastics adds products and capabilities in extreme-temperature plastics with missile applications.

Plastics Corp. of America Inc., Minneapolis, Minn., has acquired as its third plastics operation, **Cole Rubber & Plastics Inc.,** Palo Alto, Calif. The new acquisition specializes in prototype development and small custom production runs of "exotic" plastics for aircraft, missiles, electronics, and other industrial and military uses. In announcing the acquisition, **Sven K. Moxness,** PCA president, said that a new plant will be built for Cole Rubber & Plastics on a 7-acre tract in Santa Cruz, Calif. Construction will

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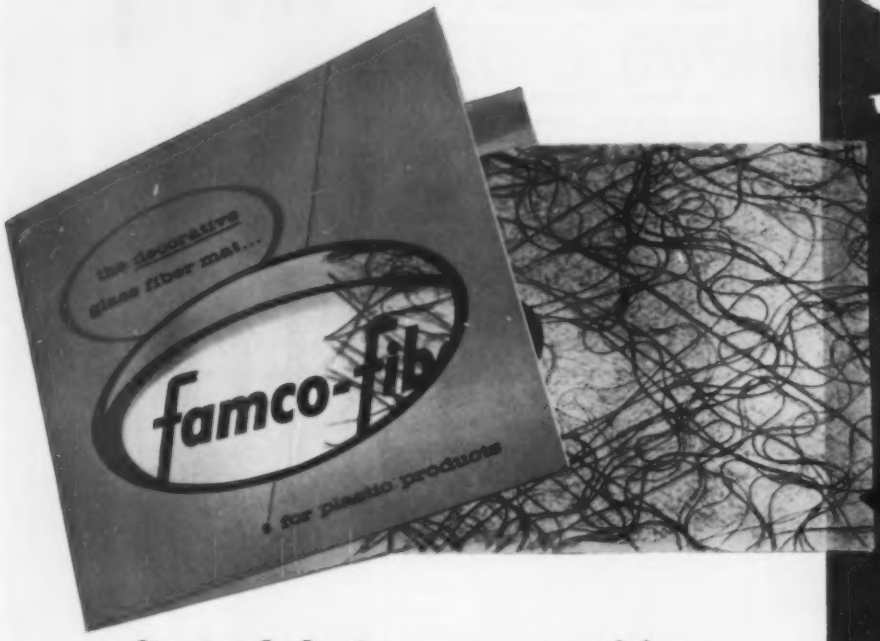

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Design possibilities are unlimited. Cotton, even metallic, threads can be incorporated into the pattern. And famco-fiber mats add strength as well as beauty to your product because all mats are made of *continuous* strands of glass fiber filaments—no bits and pieces.

Famco-fiber decorative mats are available in standard widths of 42, 48 and 60", and come in rolls 110 feet long. Phone, write or wire for more information or send for free sample pictured above.

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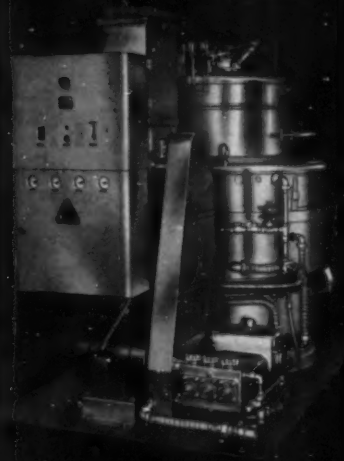

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THE PLASTISCOPE

(*From page 245*)

begin in the near future and the company plans substantial expansion in personnel as well as in plant facilities. PCA was organized in 1960 as a parent company for a group of technically oriented plastics producing firms to be acquired through merger or acquisition.

Jerome Formo named vice-president, R & D, of PCA.

Houdry Process Corp., Philadelphia, Pa., is constructing a second plant at Paulsboro, N. J., which will more than double its production capacity for Dabco (triethylenediamene), a foam catalyst introduced by Houdry three years ago. In addition to the plant, an 11,000-sq.-ft. warehouse is also being erected at the Paulsboro site; the warehouse is scheduled for completion by the end of this month, however, the plant will not be ready until the end of this year.

Trend Manufacturing Inc., Bradenton, Fla., has announced the purchase of the **Blow Molding Div.** of **Florida Plastics Inc.** All operations of Trend, which include sheet extrusion, continuous vacuum forming, blow molding, and urethane foaming, will now be located on Highway 301, one mile north of the Sarasota-Bradenton Airport. The company also announced the election of **Walter C. Lyklema** as president and **William B. Minteer** as executive vice-president.

Lawter Chemicals Inc., Chicago, Ill. has opened a new 7000-sq.-ft. plant at Rexdale, Ont., Canada, to produce fluorescent pigments. The plant is owned and operated by a subsidiary, **Lawter Chemicals (Canada) Ltd.** It is the first Canadian plant of the parent firm which operates four plants in the United States.

Pangborn Corp., Hagerstown, Md., has established a new department devoted to the manufacture and marketing of special rubber and plastics finishing machines and equipment. **William A. McCormick Jr.,** formerly branch sales manager in Boston for the Industrial Div., American-Standard Corp., has joined the Maryland firm to head the new department as its manager.

Cabot Corp., Boston, Mass. and **Acheson Industries Inc.,** Port Huron, Mich., have announced an agreement whereby Cabot will acquire the business and manufacturing facilities of **Acheson Dispersed Pigments Co.** of

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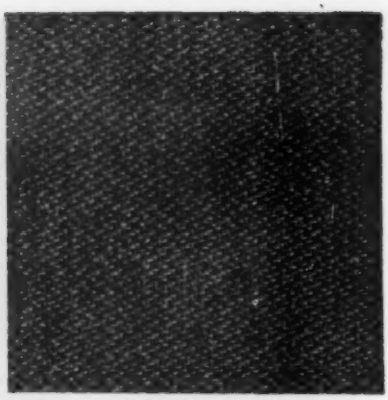
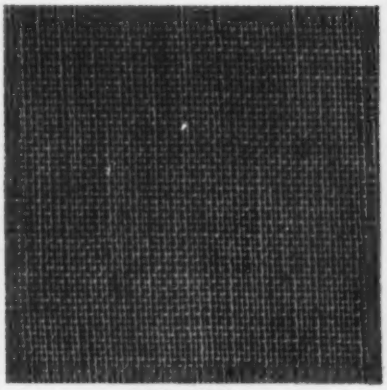
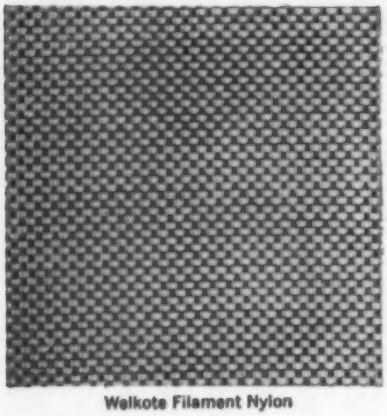

Cotton Broken Twill

Spun Dynel


Cotton Chafer

Spun Rayon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THE PLASTISCOPE

(*From page 247*)

Philadelphia, Pa., and its subsidiaries and affiliates in Orange, Texas; Xenia, Ohio; and Dukinfield, Cheshire, England, which will now become divisions of Cabot. The acquisition is expected to strengthen ADP's position in the carbon black-thermoplastic resin dispersion field and enable Cabot to pursue commercial development of its line of crosslinkable polyethylene compounds.

The Kordite Co., producer of polyethylene and polypropylene films for packaging, agricultural, and industrial applications, has announced plans for a 28,000-sq.-ft. warehouse, the second to be constructed this year at the company's Macedon, N. Y. plant. Completion of the two new warehouse structures and Kordite's $3 million, 40,000-sq.-ft. research center will provide more than ½ million sq. ft. of manufacturing, research, and storage facilities.

Martin Plastics Inc., custom extruder, from Linden, N. J., has moved to its new 40,000-sq.-ft. building at 351 Oliver St., Newark, N. J. The move coincides with a broadening of activities; in addition to its extrusion operation, the company will now also do custom molding of expandable styrene products and wire and cable coating and wrapping. **Richard Fisher** heads operations at the new plant.

Eberly Dynamics Inc. has announced purchase of **Protective Plastic Co.,** Bedford, Ohio, manufacturer of fibrous glass reinforced plastic ducts, stacks, hoods, and tanks for the processing industries as well as for chemical laboratories.

Pioneer Plastics Corp., producer of laminated plastics with plants in Sanford, Me.; Salem, Mass.; and Los Angeles, Calif., has established a new distributing company in Atlanta, Ga., to handle the company's Pionite laminated plastics and building products. The new firm, **Pioneer Plastics Distributing Corp.,** will occupy a 20,000-sq.-ft. building and will operate as a division of Pioneer Plastics Distributing Corp. of Chicago, a wholly-owned subsidiary of Pioneer Plastics Corp. The Chicago subsidiary also operates a Detroit div., and a New York distributing outlet is contemplated for the future.

N.V. Koninklijke Stearine Kaarsenfabrieken "Gouda-Apollo", Gouda, Holland, has announced formation of

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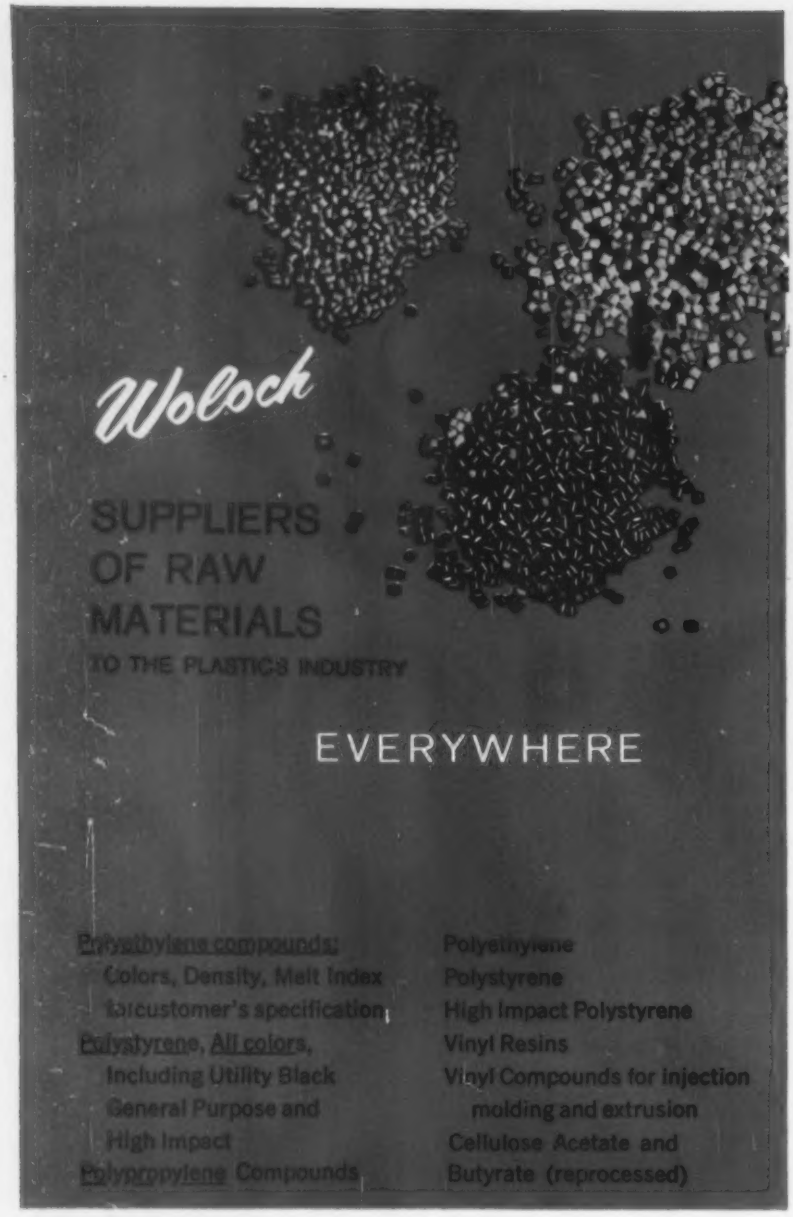

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THE PLASTISCOPE

(*From page 249*)

a subsidiary company, **Witco-Gouda Stearaten N.V.,** that will produce metallic stearates under license from **Witco Chemical Co. Inc.,** New York, N.Y. The Witco-Gouda plant, under construction on the site of Gouda-Apollo, is expected to be put on stream within a few months.

Mobay Chemical Co. has announced plans to construct a large research center in suburban Pittsburgh. The complex of new buildings will contain about 50,000 sq. ft. of functional area which will house general research facilities, customer service laboratories, administrative offices, and a technical library.

Mesa Plastics Co., Los Angeles, Calif. producer of diallyl phthalate, epoxy, and alkyd thermosetting molding compounds, has started operations at its new Eastern plant located at Copiague, N. Y. Production and warehousing facilities at the new plant occupy 16,000 sq. ft. and will service Mesa's customers in the East and in the Midwest.

New companies

Champlain-Zapata Plastics Machinery Inc., Caldwell, N. J., has been formed to produce a line of automatic molding machinery for expandable polystyrene, including integrated pre-expansion and finished parts handling equipment. **Robert H. Gow** is president; **Harvey Eisenberg,** director of marketing; **Vincent Carter,** chief engineer; and **Frank Lambert,** director of research.

Electrocal Inc., with headquarters in Canton, Mass., has been formed to make and market a recently introduced vinyl-marking transfer process. The corporation is headed by **Ridgely Shepherd Jr.,** president; **John B. Crawford,** executive vice-president; and **William Blair,** v.p., sales.

Deceased

Robert M. Aude, 47, president of the **Heyden Chemical Div.** of **Heyden Newport Chemical Corp.,** died August 20 at his home in Upper Saddle River, N. J., after a short illness.

A. J. Fisher Jr., 47, executive vice-president, **Metal & Thermit Corp.,** died August 11, at Norwalk Hospital, Norwalk, Conn.

Charles Muehlstein, 73, former vice-president and director of **H. Muehl-**

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. . . with BENZOFLEX PLASTICIZERS. BENZOFLEX is the proven low temperature fusing plasticizer with high solvation. Run molders and extruders at lower temperatures . . . and reap the extra margin of profit. Put BENZOFLEX to work for you with . . . low temperature fusing . . . flexibility . . . high solvation . . . and consistent quality and performance.

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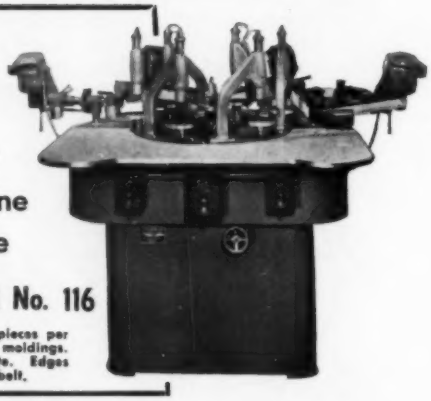

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THE PLASTISCOPE

(*From page 250*)

stein & Co. Inc., died August 13, in Chicago, Ill.

John L. Patten, plant superintendent, **Michigan Panelyte Molded Plastics Div.** of **St. Regis Paper Co.,** died July 31, of a heart attack.

Coming events

Plastics groups

Nov. 1-3: S.P.E. 1st Southwestern Packaging exhibition in conjunction with North Texas Section, Retec on "Plastics in Packaging," Sheraton-Dallas Hotel, Dallas, Texas.

Nov. 15: S.P.E. New York Section with cooperation of Vinyl Plastics PAG, Retec on "Vinyl Plastics in the Household," Statler-Hilton Hotel, New York, N. Y.

Dec. 1: S.P.E. Cleveland Section, Retec, "Screw Injection Molding," Sheraton Cleveland Hotel, Cleveland.

Dec. 7, 8: S.P.I. 9th Plastic Film, Sheeting, and Coated Fabrics Conference, Pierre Hotel, New York, N. Y.

Dec. 9: S.P.I.-S.P.E. Midwest Sections, Annual Christmas Party, Grand Ball Room Pick-Congress Hotel, Chicago, Ill.

Jan. 30-Feb. 2, 1962: S.P.E. 18th Antec on "Plastics Revolutionize Design," Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 6-8: S.P.I. 17th Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill.

May 19-29: Europlastique 62, Porte de Versailles, Paris, France. Contact: Paul Thevenin, Secretariat d'Europlastique, 10 Rue du Mont Thabor, Paris 1e.

Other groups

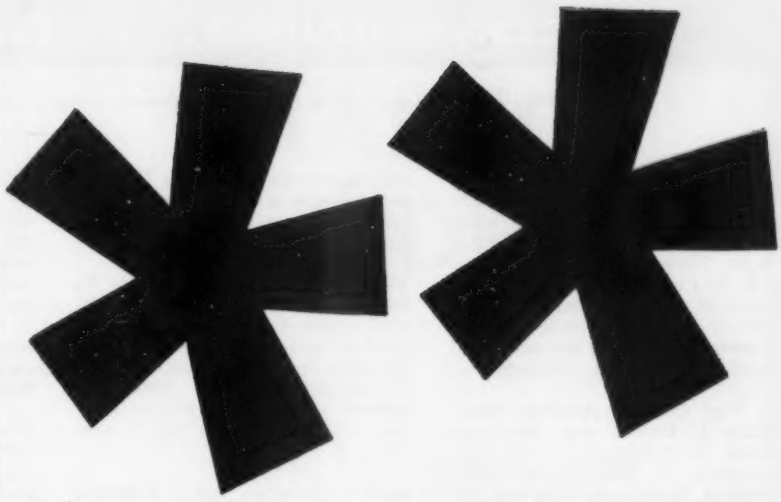
Oct. 31-Nov. 2: 10th Canadian National Packaging Exposition, Automotive Bldg., Exhibition Park, Toronto, Canada.

Nov. 7-10: Packaging Machinery Mfrs. Institute Show, Cobo Hall, Detroit, Mich.

Nov. 27-Dec. 1: 28th Exposition of Chemical Industries, Coliseum, New York, N. Y.

Dec. 5-7: Building Research Institute Fall Conferences, Shoreham Hotel, Washington, D. C.

Jan. 15-19, 1962: 36th National Housewares Exhibit, McCormick Place, Chicago, Ill.—**End**



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COMPANIES...PEOPLE

Firms and personnel in the news—what they're doing . . . and where

Goodyear Tire & Rubber Co.—Films & Flooring Div.: G. E. Lewis, former film sales rep., Cleveland, Ohio, transferred to West Coast dist. as Plastic Film & Sheeting sales rep. **R. E. Barr** transferred from Akron to Cleveland as Plastic Film & Sheeting sales rep. in that area. He is succeeded in Akron by **D. Estes,** who was transferred from the Foam Products Div.

Du Pont Co.—Polychemicals Dept.: Milton J. Roedel, mgr. marketing section for Delrin acetal resin pipe, transferred to Development Dept. **Robert A. Kellar,** marketing mgr. for Teflon fluorocarbon resins replaces Dr. Roedel. **Albert A. Pavlic,** mgr. plastics sales section, becomes marketing mgr. for Teflon. **R. Jack Manning,** asst. mgr. plastics sales, succeeds Dr. Pavlic.

F. J. Stokes Corp., Philadelphia, Pa., established a West Coast facility in Pasadena, Calif., to provide tech. service and stock standard items of equipment for vacuum processing, molding, tabletting and compacting. **F. Theodor Hahn** appointed dist. mgr. in charge of the new facility, with **Albert V. Bicknell** as sales engineer for the company's Press Equipment Div., **James A. Fox** as sales engineer, Vacuum Equipment Div., and **John A. Kershaw** as dist. service engineer.

Wallace & Tiernan—Lucidol Div., R & D Laboratory: Dr. Orville L. Mageli named research mgr., **Dr. David G. Guthrie,** supv. product and process development, and **Dr. Arthur I. Lowell,** supv. application research.

Flexible Products Co., Marietta, Ga., has expanded its vinyl formulating operations to include vinyl solvent solution and emulsion systems, epoxy compounds, and urethane components for coatings, elastomers, and foams. **Joe McCormick** and **Peter Blom** named sales engineers for the entire product lines, and **Martin Kovarik** named product mgr. for the company's urethane materials.

Koppers Co. Inc., Pittsburgh, Pa.: **John S. Atwood** appointed asst. to v-p, Plastics Div. **B. R. Sarchet** named head of the newly established Panel Dept. Previously the company's building panel activities had been operated within the Plastics Div.

Armstrong Cork Co.—Packaging Materials Div.: V. A. Game, formerly mgr. metal and molded cap sales, named mgr. of plastic container and closure sales. This dept. includes compression-molded closures, injection-molded closures and containers, blown plastic containers, and other plastics specialties. **William H. Powers,** formerly coordinator of plastics commercial development, has been named asst. mgr.

The Borden Chemical Co.: Otis W. Fortner appointed works mgr. of the vinyl acetate and methanol plants located at Geismar, La. The two plants are under construction and scheduled for completion in 1962. **William E. Driscoll** named Midwest dist. sales mgr., Polyco Monomer Dept., with offices in Elmhurst, Ill.

Hercules Powder Co., Polymers Dept.: James W. L. Monkman named to newly created post of dir. of sales for plastics. The following dist. mgrs. appointed for plastics sales: **Charles A. Borton,** Cleveland, Ohio; **John L. McKeen,** Chicago, Ill.; **Paul J. Metzger,** West Coast; **Daniel G. Welsh,** Cincinnati, Ohio; **Robert R. Stover,** New York, N. Y. Materials manufactured and sold by the Polymers Dept. include Pro-fax polypropylene; Hi-fax high-density PE, and Penton chlorinated polyether.

Shell Chemical Co.—Plastics & Resins Div.: R. M. Maybee named mgr., plastics tech. service at Union, N. J. lab., assisted by **V. O. DeCoster** as supv. tech. service—olefins, and **P. M. Ciofalo** as supv. tech. service—polystyrene. **R. E. Brown** appointed tech. service supv.—resins, and **F. T. Watson,** sr. technologist.

Union Carbide Plastics Co.: William C. Nissen assigned as project mgr., polypropylene, new products marketing dept. **Quentin Nelson & Co.,** Houston, Texas, appointed sales agent for protective and decorative paint industry in the state of Texas.

Allied Chemical Corp.—Plastics Div.: Robert F. Traflet appointed product mgr. of A-C polyethylene. **Dr. Reginald F. Webb** named dir. of research, with headquarters in Morris Township, N. J.

General Chemical Div.: Robert A. Miller appointed sales mgr. for Aclar fluorohalocarbon film and Capran polyamide film, both recent developments of Allied Chemical research. **Charles B. Miller** and **Dr. Curtis B. Hayworth** named asst. tech. dirs.

Barrett Div.: Don A. Proudfoot named gen. marketing mgr.; **Joseph W. Donegan,** mgr., tech. service; **Richard K. Eberts,** mgr. development research; **Robert L. Harris,** mgr. lab. research; and **Frank P. Maxwell,** mgr. development engineering.

DeBell & Richardson Inc., Hazardville, Conn.: The following specialists appointed to Plastics R & D Laboratories: **Herbert A. Ehrenfreund,** project engineer, packaging development with emphasis on foamed materials and processes. **J. Robert Fisher,** sr. project engineer, product development. **Dr. Dudley M. Gallagher,** sr. chemist, specialist in organic synthesis and polyester fibers. **B. J. Skowronski,** sr. chemist, specialist in elastomer compounding; and **Henry C. Winiarski,** sr. chemist, compounding.

Flexible Tubing Corp. has opened a sales and engineering office in St. Louis, Mo., headed by **F. Richard Krabbe.** Company headquarters are in Guilford, Conn., with a branch plant in Anaheim, Calif., and subassembly facilities in Hillside, Ill.

Enjay Chemical Co.: Joseph W. Calby named mfg. coordinator, Plastics & Resins Div. **W. L. Van Nostrand, Jr.** joined Enjay Laboratories, Linden, N. J., to conduct application and tech. service work on Buton thermosetting hydrocarbon resins.

Foster Grant Co. Inc.—Plastic Sales Div.: Frank H. Wilson named product mgr., nylon film, sheet, and monofilament in Leominster, Mass. office. **Frank C. Donofrio** named sales rep., working out of Berea, Ohio, branch office. **Robert H. Simon** joined the New York sales branch.

Bemis Bro. Bag Co.: F. G. Bemis, Jr. elected v-p. He will continue as dir. of allied operations, responsible for the company's Visinet Mill, paper specialty and plastic packaging plants, and will headquarter at gen. offices in Boston, Mass.

Air Formed Products Corp., subsidiary of Bemis Bro. Bag Co., producer of blow-molded containers and industrial shapes: **Walter Conway** heads newly opened sales office in New York, N. Y. **John S. Whitney** named Western regional sales mgr. with headquarters in Chicago, Ill.

Owens-Illinois Glass Co.: F. D. MacIver Jr. appointed to newly created position of gen. dist. mgr., Closure and Plastics Div. sales. **G. P. Mead Jr.** succeeds Mr. MacIver as Chicago, Ill. dist. sales mgr. **H. M. Powell Jr.** named mgr. of a new sales dist. in Atlanta, Ga. area.

Thatcher Glass Mfg. Co. moved its plastic tube manufacturing plant from Nashua, N. H., to its more centralized plant at Muscatine, Iowa, where it also maintains its Celon closure div. plant. **Henry E. Griffith,** v-p in charge of plastic container marketing will direct sales from New York exec. offices.

Thatcher has licensed **Peerless**

Tube Co., mfr. of collapsible metal tubes and aluminum aerosols, to produce polyethylene, vinyl, and polypropylene squeeze tubes currently manufactured by Thatcher's plastic tube div.

FMC Corp.: Theodore R. Hopper appointed to the epoxy application group at the company's Princeton, N. J., R & D laboratories.

Hydro Chemicals Inc. has opened a new manufacturing plant and offices in Los Angeles, Calif., for production of high-density PE containers, bottles, and jars. **Sam Melcher** named dir. of Western operations.

Johnston Industrial Plastics Ltd., Toronto, Ont., named distributor for Plexiglas by **Rohm & Haas (Canada) Ltd.,** and for Seilon polyolefin sheeting products by the **Plastics Div. of Seiberling Rubber Co.,** Newcomerstown, Ohio.

The Blane Corp., Canton, Mass. mfr. of vinyl and PE compounds and color concentrates: **Stanley J. Trykowski** appointed tech. dir.; **Sumner Levin** named mgr., plant operations.

Tube Turns Plastics Inc., Louisville, Ky., mfr. of injection-molded fittings and components for plastic pipe: **T. S. Bushnell** promoted to new position of sales mgr., special products. **James L. Sheehy** succeeds Mr. Bushnell as Midwest dist. mgr. in Chicago, and **Cliff M. Springmeier** succeeds Mr. Sheehy as West Coast northern district mgr. in San Francisco.

Lenox Plastics Inc., St. Louis, Mo.: **D. C. Johnson** and **Robert H. Dewalt** of **Johnson-Dewalt Co.** appointed exclusive sales reps. for Lenox melamine dinnerware.

Apex Tire & Rubber Co., Pawtucket, R. I., established a Color Div. for manufacture of color concentrates for vinyl processors. The new div. will complement the company's present activity as producer of vinyl compounds for extrusion and molding operations.

The Heminway & Bartlett Mfg. Co., New York and Watertown, Conn., named sole selling agent in U. S. and Canada for **Lamart Corp.,** Clifton, N. J., processor of metallized products made from Mylar.

Synthane Corp., Oaks, Pa., mfr. and fabricator of industrial laminated plastics, established a St. Louis, Mo., sales office with **A. J. Rouse** as factory rep. **David Garrison** named Philadelphia dist. sales mgr.

Industrial Plastic & Engineering Co., Orange, N. J., molder and fabricator of Kel-F, Teflon, nylon, phenolics, and other plastic products in sheets, rods, tubes, etc., has opened a branch plant in Venice, Calif., to serve the 11 Western states.—**End**

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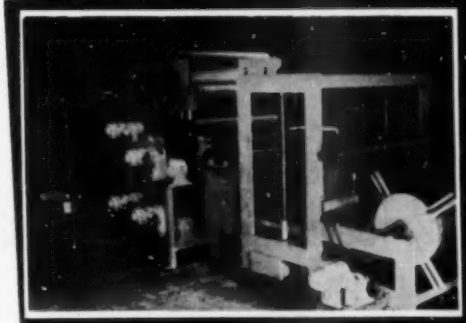

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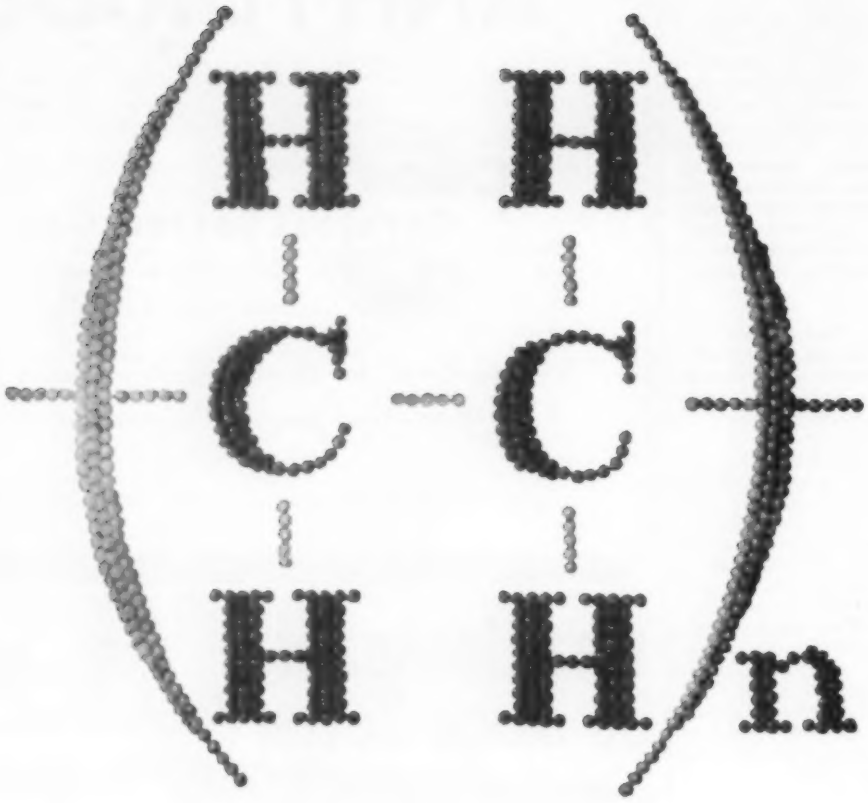
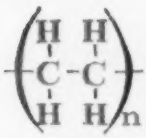


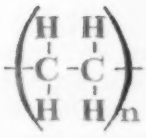
THAT EXTRA TOUCH OF GRACE: Technical Information

The flood of daily data about new plastics resins, equipment and developments in molding and fabricating seems never-ending. How can any one person keep up with it? The Grace staff is prepared to help plastic resin customers in their search for specific technical information. Your Grace representative offers a variety of Grace publications plus the literature resources of the Grace libraries. This is another of the ten major services available under the Grace Service Plan; your representative has details.



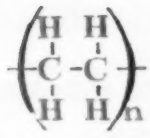
TECHNICAL INFORMATION ON BLOW MOLDING

The following bulletins and reprints are available: Blow Molding of Hollow Objects With High Density Polyethylene; Engineering Aspects of Blow Molding Linear Polyethylene; Blow Molded Containers: Collapse Problems-Recommended Solutions; Low Density Polyethylene Resins For Blow Molding; Blow Molding (Reprint-British Plastics); Blow Molded High Density Polyethylene Containers For Household Bleach; Packaging of Gasoline in High Density Polyethylene Containers; Selection of High Density Polyethylene Resins For Liquid Starch and Textile Rinse Containers. Ask for your Copy.



TECHNICAL INFORMATION ON INJECTION MOLDING

The following bulletins and reprints are available: Molder's Guide to Injection Molding of High Density Polyethylene; Improved Dry Coloring With High Density Polyethylene; Mold Finishes For High Density Polyethylene; Dry Tumbled Blends With High Density Polyethylene; Low and Medium Density Polyethylene Resins For Injection Molding; High Density Polyethylene Blends For Injection Molding. Ask for your Copy.



TECHNICAL INFORMATION ON EXTRUSION

The following bulletins and reprints are available: Fabricator's Guide to Extruding High Density Polyethylene; Plastic Pipe From High Density Polyethylene; Film Grade Resin 2201; Low Density Polyethylene Resins For Flat and Blown Film Extrusion; Design Stresses For Polyethylene Pipe; The Monofilament Tester; Techniques in the Extrusion of High Density Polyethylene Tubing and Profiles. Ask for your Copy.

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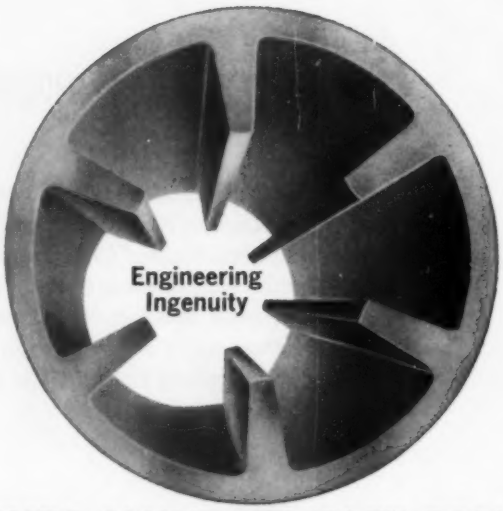

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FOR SALE: In excellent operating condition, Used Injection Molding Machines: 1—Watson-Stillman PE-64, approx. 5 years old, 1—Watson-Stillman 48 oz. Preplasticizing machine, 1—Watson-Stillman 16 oz. machine, approx. 5 years old, 1—Watson-Stillman 12 oz. machine, approx. 6 years old. Machines may be seen in operation in Eastern Ohio. Reply Box 7036, Modern Plastics.

FOR SALE—One 3 Roll Thropp Calender 18" x 54". 90 H.P. Variable speed D.C. motor. 125 H.P. M.G. Set. Controls. Reply Box 7038, Modern Plastics.

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INJECTION MOLDING—HPM 9 oz; Hydraulic Press, French oil semiautomatic 100 ton; Mill-Farrell 16 x 36; Baker Perkins SS 100 Gal 2 Arm Jac. vac. Hyd. tilt 50 HP; 150 Gal Day Imperial Sigma; 3 Baker Perkins 100 Gal Sigma Jac. Hyd. tilt; Calender 3 roll 18 x 48 Burmingham; Extruder 8" elec. heated; Ram extruder: Machinecraft Corp., 800 Wilson Ave., Newark, N. J. MI-2-7634.

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FOR SALE—Stokes Molding Presses. 50 Ton, model 741. Full Automatic. Also Stokes Standard 50 ton, Semi-Automatic. Blow Molding Set Up—2" Kato, One year old, complete with all controls and blow molding equipment. With variable speed drive. Injection Molding Machines—4 oz. Harvey, 8 oz. Reed Prentice, 12 oz. DeMattia, 12 oz. Reed Prentice. All In Stock. Immediate Delivery. Defiance Model 20 Single Punch Preform Press. Complete with U.S. vari drive. 1" NRM Lab Extruder, complete with drive and controls. 2" National Erie. Electrically Heated Extruder with vari drive and extra screens. Scrap Grinders—1½ HP up to 50 HP available. We have a full line of Laminating Presses, Molding Presses, Mills, Calenders, Extruders, Injection Molders, Scrap Grinders, Coating Equipment and other accessories for the Plastic Industry. We Will Finance. Johnson Machinery Company, 90 Elizabeth Ave., Elizabeth, N. J., EL 5-2300.

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FOR SALE—Plastic Vacuum Forming machine, two station, 4' x 6' platens. New 5 HP Compressor, 3 HP vacuum pump. Complete switch panel, 12 molds, Band saw with 1½ HP, var. speed motor, Router. Many misc. items must move very quickly, at small fraction of value. The Sheldon Mail, Sheldon, Iowa.

FOR SALE—Fiber Glass 52" Preformer. Fiber Glass Ovens. Turner Roving Cutter. 500 ton W-S hobbing press. 500 ton Utility five 48" x 30" platens. Four 300 ton Molding Presses various makes. HPM 200 ton downstroke. Watson-Stillman 240 ton, ten 24" x 58" platens, W & W 200 ton, 24" x 42". Stokes Standard 150 & 50 ton semi-automatic. D&B 150 ton, 25" x 25". French Oil 120 ton self-contained. 50 ton Birdsboro 24" x 20" Stokes 15 ton automatics. Hydraulic pumps and accumulators. New ¾" plastic extruder. Other sizes to 6". Banbury #3 Mixer. Seco 6" x 12" 2-roll Mills and Calenders. Farrel & Thropp 40" & 48". Other sizes to 60". Despatch electric heated ovens and other types. New ¾ oz. Bench Model Injection Machines. Van Dorn 1 and 2 oz. Other sizes up to 100 oz. Baker-Perkins and Day jacketed Mixers. Taylor-Stiles Pelletizer, 3 HP. Plastic Grinders. Stokes & Colton Preform Machines. Partial listings. Send for Bulletin #192. We buy your surplus machinery. Stein Equipment Co., 107-8th St., Bkyln 15, N.Y. ST 8-1944.

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FOR SALE—(2) Baker Perkins, jacketed, heavy duty; DeVine 9 shelf vacuum dryer; Stokes Mod 59-B, and 4x9, 2-roll vacuum dryers; Pfaudler Reactors glass lined, jacketed, ASME coded, 100-300-500 Gal.; DeMattia plastic granulator; (2) Foremost plastic scrap grinders. Reply Box 7039, Modern Plastics.

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WANTED—Plastic molding injection machine. From 5 to 16 ounces. Reply Box 7045, Modern Plastics.

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NYLON SCRAP wanted by reprocessors. Quotations promptly furnished on all grades of nylon extrusion (including wire coating), molding and fabricating scrap. Adell Plastics, Inc., 5208 Eleanora Ave., Baltimore 15, Md.

(Continued on page 262)

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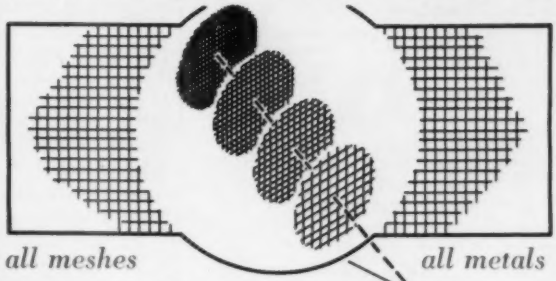

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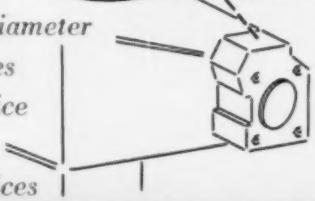

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(Continued from page 260)

PLASTIC SCRAP WANTED—Clear Acetate and Butyrate sheet scrap, cast acrylic, acrylic molding powder, styrenes, etc. We pay top dollar for your plastic scrap and surplus molding powders. Write, wire or phone collect—TL 3-3111—Philip Shuman & Sons, Inc., 571 Howard Street, Buffalo, New York.

Help Wanted

ASSISTANT PRODUCTION MANAGER—Prime manufacturer of thermoplastic molding compounds requires Chemical Engineer to assist manager in operating its plastics production division. A minimum of 8 years experience in all phases of thermoplastics production is essential. Excellent potential with one of the leaders in the plastic industry. New England location. Please write Box 7043, Modern Plastics.

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SALES ENGINEERS—Standard mold set manufacturer requires additional representatives in several areas. Applicants must have proven selling abilities as well as moldmaking background. Protected territories. Write stating experience and qualifications. National Tool & Manufacturing Company, Kenilworth, N. J.

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PLANT MANAGER, medium size established Custom, Compression and Transfer Molder offers excellent opportunity to right man. Must have supervisory background, knowledge of thermosetting materials, engineering, maintenance and production. Office and plant responsibilities. Send resume and salary requirements. Accurate Molding Co., Inc., 35-20 48th Avenue, Long Island City 1, New York.

WANTED — PLASTICS CHEMIST OR ENGINEER — With practical experience and knowledge in the area of polyvinyl chloride—testing or experimental work. Prerequisite is a special knowledge or experience in PVC stabilizing. We are interested in a young, German speaking chemist, who desires to broaden his general knowledge and is interested in a two year contract with an important German chemical company. We are asking for a thoroughly experienced technical expert under contract, if possible. We are interested in one who wants to learn about working conditions, working methods, and recruiting of technical service in the German chemical industry. Under such circumstances we are also in the position after the end of the contract to mediate in getting him a new position in his own country. Solicitation with a statement of education and previous work record in summary form. Please submit resume in his own handwriting, of his education, and work record in the form of a table. Reply Box 7033, Modern Plastics.

SALES REPRESENTATIVE — A major extruder of custom thermoplastic sheet requires the services of a sales representative experienced in the sales of thermoplastic. Territory open in New York, New England, Midwest. Excellent quality, delivery, and most competitive prices in the industry. Stock option plan. Excellent financial arrangements for aggressive representative. Reply in confidence, Box 7041, Modern Plastics.

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MODEL MAKER, SCULPTOR—Working Designer seeks responsible, challenging position model and development work for plastic firm. Have extensive design and technical experience for blow molding, vacuum forming, injection molding for toys, housewares, etc. Reply Box 7048, Modern Plastics.

BLOW MOLDING CONSULTANT—B.S. in M.E., B.S. in B.A., M.B.A., 35 years old, 15 years experience. Will set up a blow molding operation, recommend machinery, install it, design and supply utilities, design and procure molds and finishing equipment, train personnel. References supplied. Write to Box 7034, Modern Plastics.

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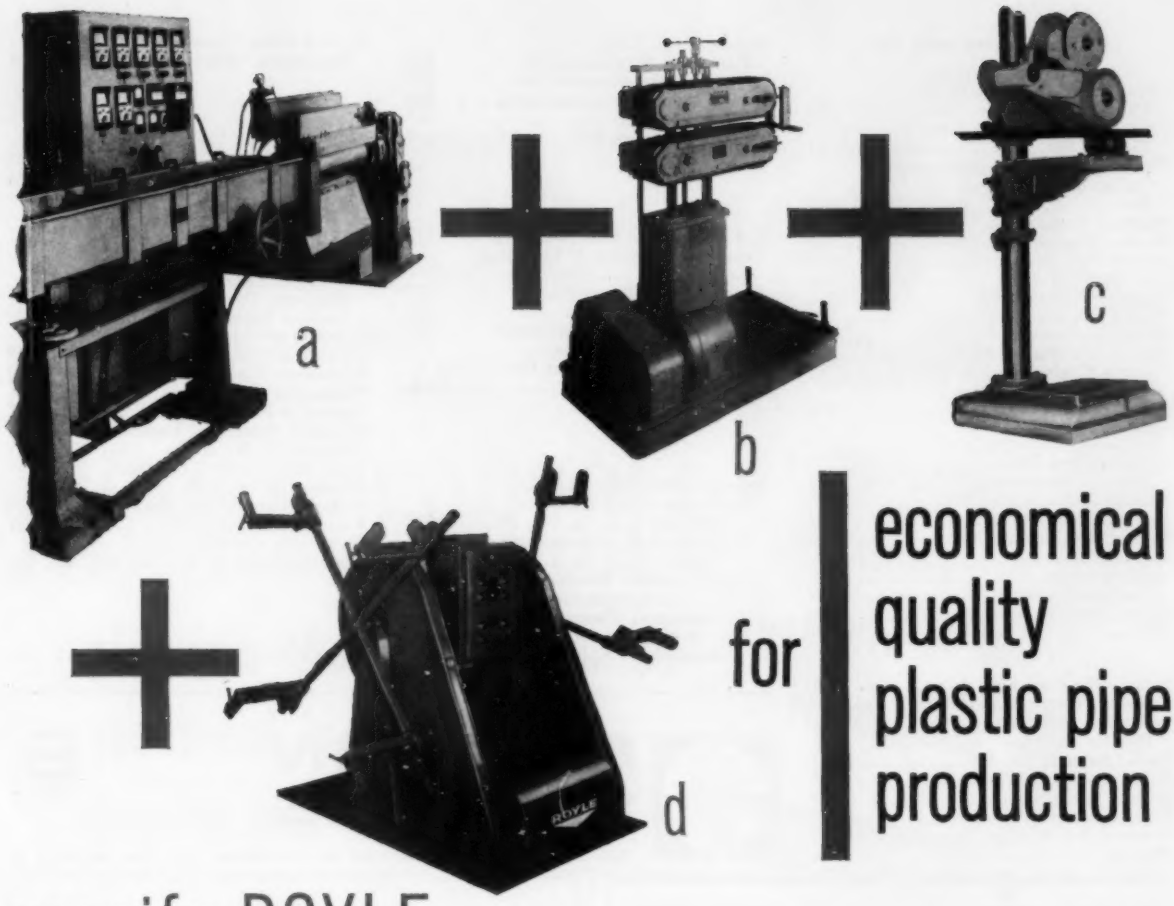

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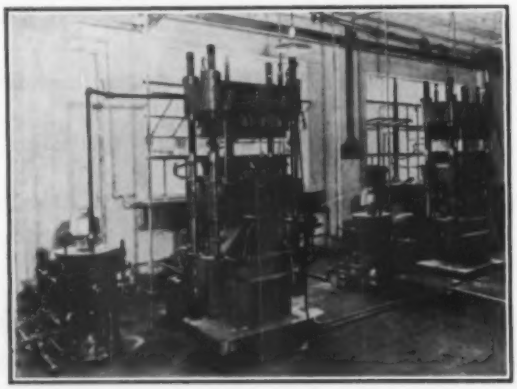

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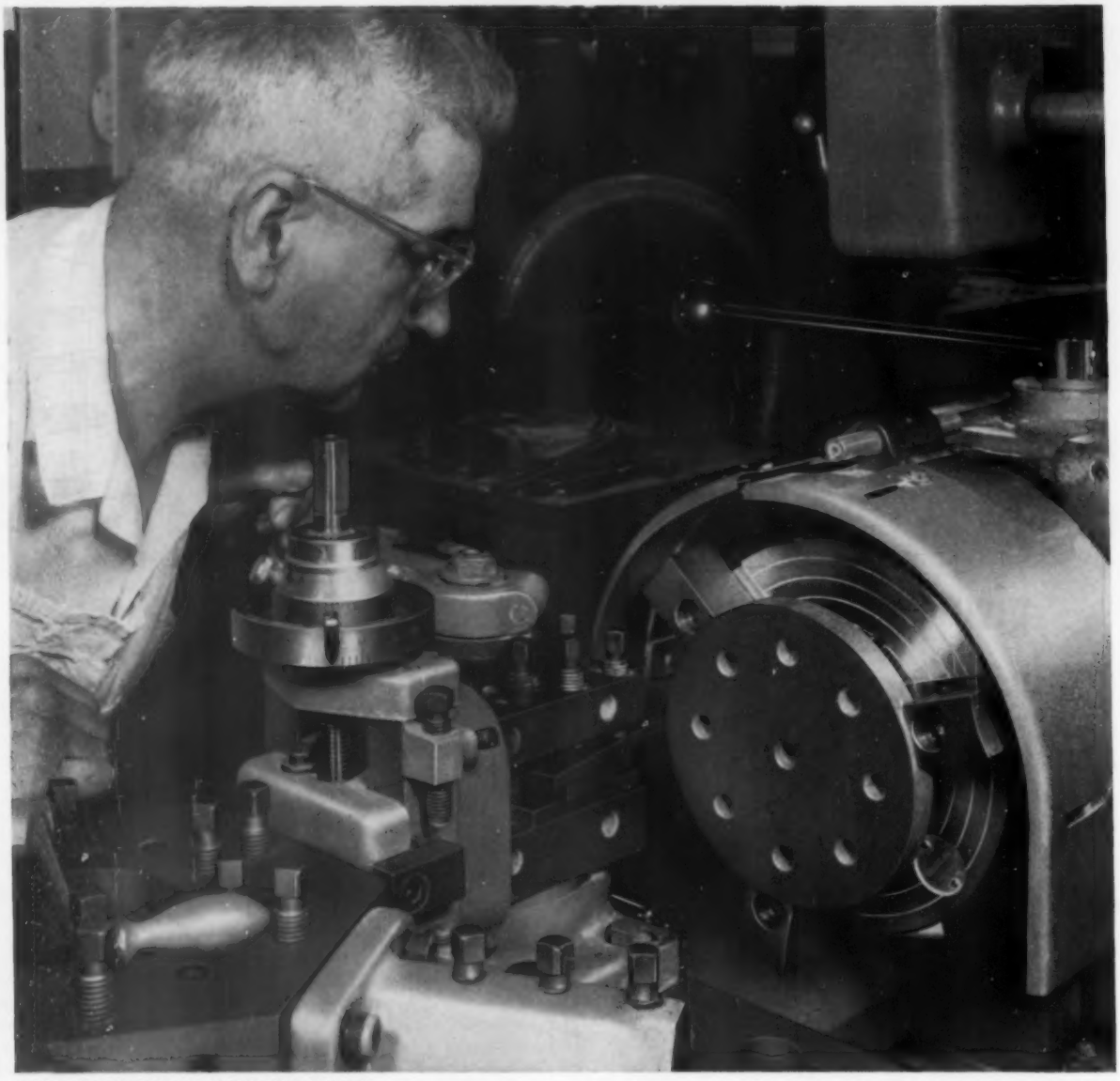

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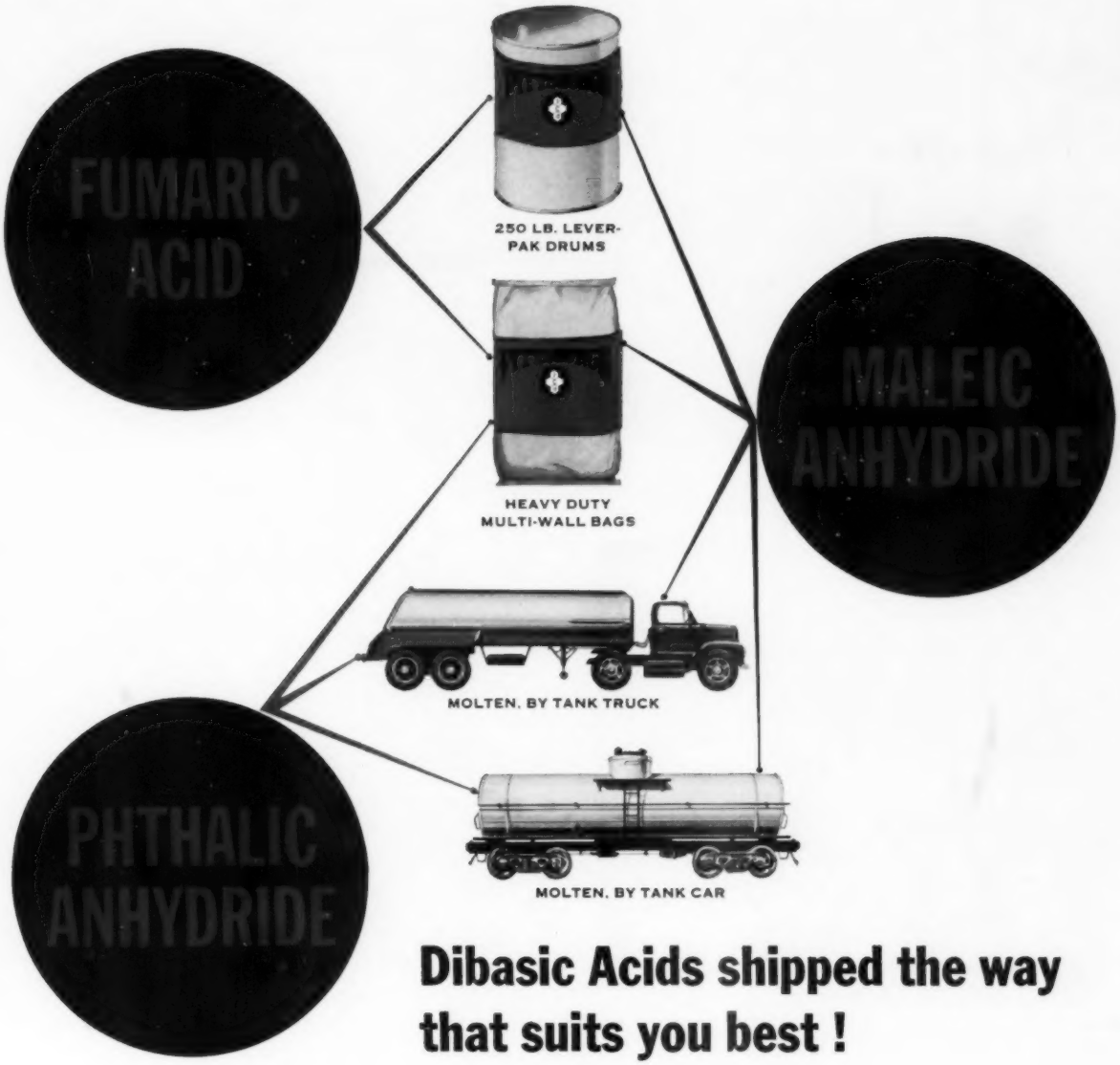

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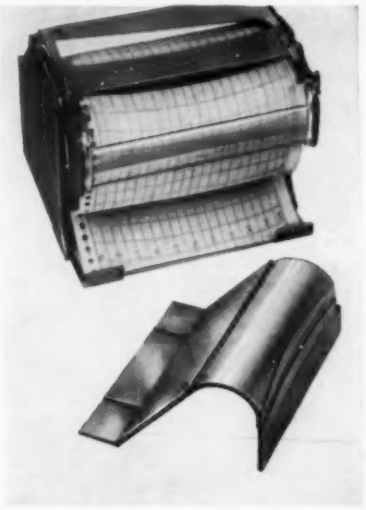

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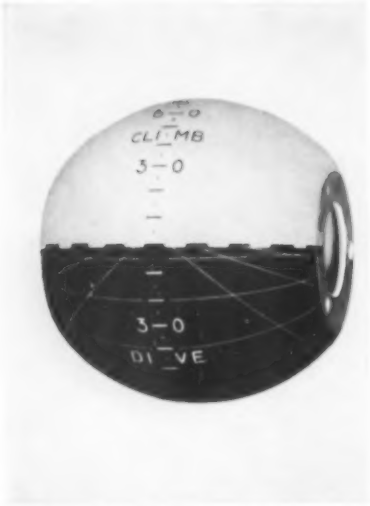

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